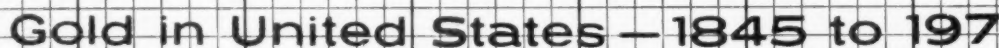
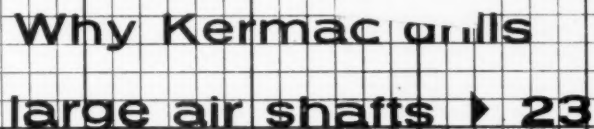


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26



Utah licks water at Shirley Basin

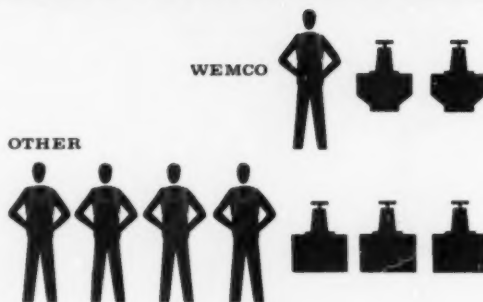
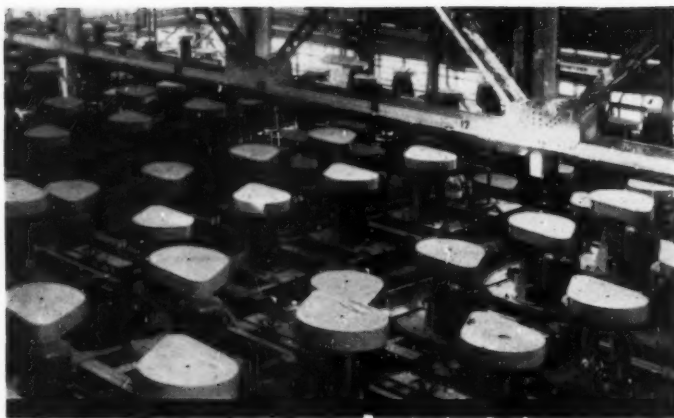
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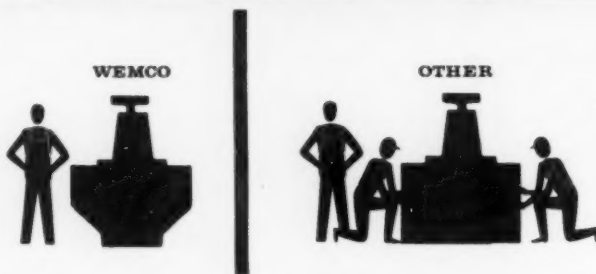
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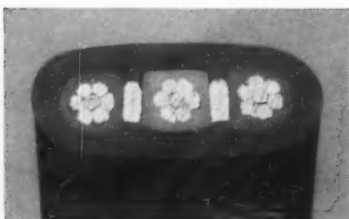
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ABOUT THE NEW AC SHUTTLE CAR CABLE



Shirley Basin's deep uranium ore is sandy and wet so underground mining has been most difficult. Utah Construction, the first producer to go underground, has had to use tightly lagged and closely spaced square sets to mine the unconsolidated sand 20

Rotary drilling speeds sinking of air shafts at Ambrosia Lake, New Mexico. In one shaft 56 feet was average daily advance. Drilling and hanging casing cost \$48.00 per foot 23

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MILLER FREEMAN PUBLICATIONS



MINING WORLD, January, 1961. Volume 23, No. 1. Published monthly except April, when publication is semi-monthly at Lancaster, Pa. Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North Central and South America, \$4.00 per year; other countries, \$5.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Lancaster, Pa., under act of March 3, 1879. Postmaster, please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

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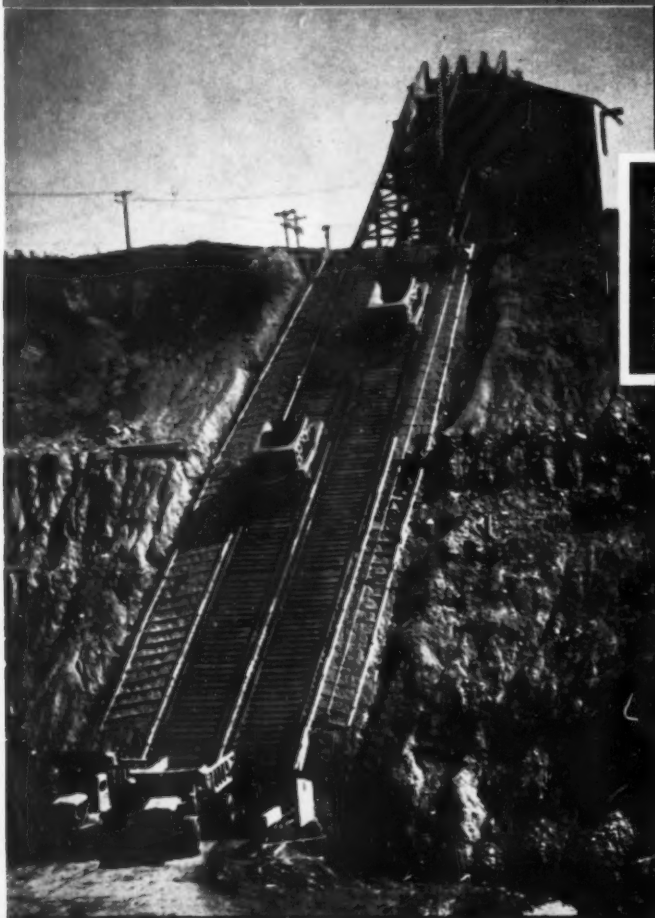
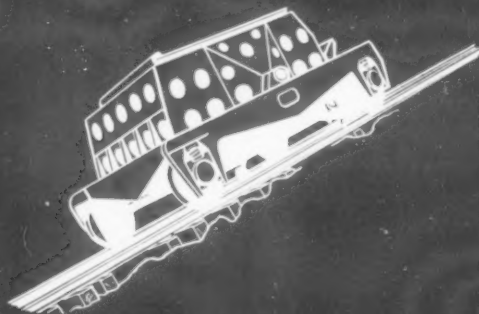
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Published by Miller Freeman Publications
Wm. B. Freeman, President
Miller Freeman, Jr., Exec. Vice-President & Treas.

SUBSCRIPTION RATES:
U.S., North, South and Central America \$4.00
Other Countries \$5.00
Single Copies \$.50
Directory Number \$1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 300 Howard Street, San Francisco 5, California. Include both old and new addresses and zone numbers.

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Mine More Gold

The London Gold Rush, the continuing drain on the United States' gold reserves, and the drastic steps taken to prevent spending of United States dollars abroad have drawn the attention of all citizens to gold.

Unfortunately there have been too many proposals by too many economists, professors, bankers, and hysterical Armed Services wives about the gold crisis. Unfortunately all of them have failed to remember that the United States gold reserves are not fixed, nor is the gold turnover a one-way street.

Starry-eyed bankers dream of unenforceable, foolish, and without doubt unlawful proposals to prevent United States citizens from owning gold outside the United States. This proposal, which would establish different laws, rules, and regulations for citizens dependent solely on their geographical location is a typical example of high level thinking to solve the gold crisis.

At long last the country now has a clear, definite, and meaningful statement on gold—a statement and recommendation to call attention to the long neglected yet so obvious fact that the gold reserve can be increased by mining more gold. Gold so obviously is not a one way street.

It took Dr. Donald H. McLaughlin, president of the Homestake Mining Company, to point out that the way to increase gold production was by federal subsidies. Speaking before the State of California Committee on Manufacturing, Oil, and Mining he recommended a small subsidy to mines already producing, with larger subsidies for closed and new mines.

The gold problem is not a one-way street. We need more gold, not illogical and crazy schemes to conserve what we have.

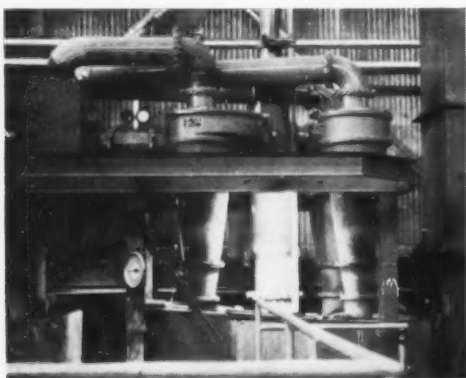
Meet Fred Sargent

This is your introduction to MINING WORLD-WORLD MINING's new midwest district manager, Fred R. Sargent, who is making his headquarters in Chicago, Illinois. He will be in charge of advertising sales and services in this area which includes the important Minnesota and Michigan Iron Ranges, the nation's largest zinc-producing district—eastern Tennessee—and the new lead and iron belts in Missouri.

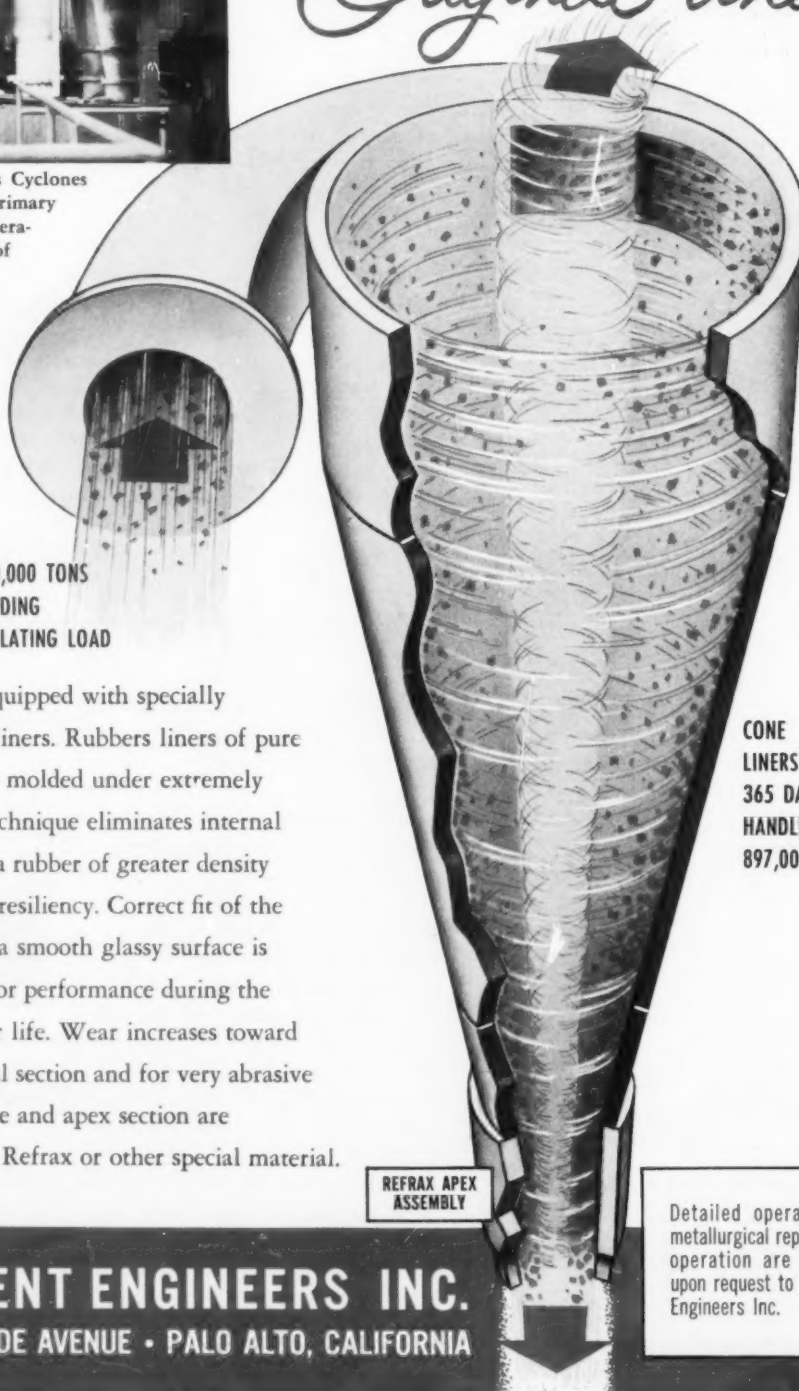
Fred's education and engineering experience make him ideally suited for service to all MINING WORLD advertisers and readers in this area. In 1951 he graduated from the College of Mines at the University of Arizona as a mining engineer. He immediately started working for Kennecott Copper Corporation at Ray, Arizona. During his employment at Ray he worked in the engineering, industrial engineering, and mine production departments, with a leave of absence to serve in the United States Navy during the Korean War. Fred left Ray as pit production scheduling foreman and went to work as assistant pit superintendent for Kaiser's Permanente Cement Company at Permanente, California. He resigned this position to join MINING WORLD. His knowledge of large scale open pit mining will be a welcome addition to the professional diversity of the staff.



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GOVERNMENT ACTION AND REACTION AFFECTING MINING



New Congress Gets Many Minerals Bills . . .

A field in which early legislative action can be expected is the one connected with the domestic production of such minerals as lead and zinc, fluorspar, manganese, tungsten, etc., the producers of which have

been put out of business because of withdrawal of government subsidies and competition from foreign imports. The same coalition of senators and representatives, who last session pushed through the lead-zinc bill

only to have it vetoed, can be expected to present to Congress a broader type of minerals legislation. They were highly encouraged when candidate Kennedy stated he would have signed the lead-zinc subsidy bill.

Udall's Interior Secretary Appointment Receives General Approval From Miners . . .

The principal news from Washington revolves around the selection of the members of his cabinet by President-elect Kennedy—and rumors about the appointments still to be made.

From the beginning, Representative Stewart Udall of Arizona seemed to be the favorite for Secretary of Interior. Therefore, the formal announcement on December 7 came as no surprise. He will resign from Ari-

zona's second congressional district. At 40, he will be the youngest Interior Secretary since Julius Krug in 1946. Also, he is the first and only citizen of Arizona ever to be given a cabinet post.

When he accepted the appointment he said, "In many ways my own state is a compact image of the Interior Department." He plans to do much more for the American Indians, for conservation, reclamation,

public power, and public lands. While he has not publicly announced any plans for mining he knows the industry and its problems from membership in the House Committee on Interior and Insular Affairs. He has supported lead-zinc bills, the domestic minerals stabilization program, and purchase of copper.

There seems to be general agreement that Udall will make a good Secretary of the Interior.

Lead-Zinc Import Quotas Will Continue To Apply . . .

The White House, on November 25, announced that President Eisenhower had concurred in a recent finding of the Tariff Commission that no move should be made at this time toward relaxation of the quotas on lead and zinc established in October 1958. The President's action means that the quotas will continue.

The announcement said that President Eisenhower agreed with the Tariff Commission that there was not sufficient reason at this time to reopen the escape clause action

which resulted in quotas on imports. The commission's study was made under an executive order which requires a periodic review of affirmative actions taken under the escape clause, which permits quotas when imports threaten the industry.

The President's decision was no surprise to the lead and zinc producers. His approval of the Tariff Commission's findings had been deemed a foregone conclusion.

However, two unknown factors still confront the industry. The first

one concerns the position which the new Administration will take when it comes into power in January. Some foreign producers are hopeful that quotas will be abolished, but admit it largely depends upon President-elect Kennedy's selection of appointees to key minerals posts.

The second unknown is what action Congress may take in response to urgings from that segment of the industry which favors scrapping of import quotas and increasing import duties on the two metals.

Aluminum Producers Will Fight Tariff Cuts on Primary Aluminum . . .

Domestic producers of aluminum are registering their opposition to the United States government's decision to place primary aluminum and alloys on a supplementary list of items on which the United States is willing to make tariff concessions at the General Agreement on Tariffs and

Trade in Geneva in January.

The major producers are expected to urge dropping primary aluminum from the bargaining list when public hearings are held by the Tariff Commission and the Committee for Reciprocity Information starting January 5, 1961. If successful, they

probably will attempt to secure a limit on any tariff concession at the so-called "peril-point" hearings at which the Tariff Commission will study the point below which the duties cannot be cut without injuring domestic industries. The present tariff is 1.25 cents a pound.

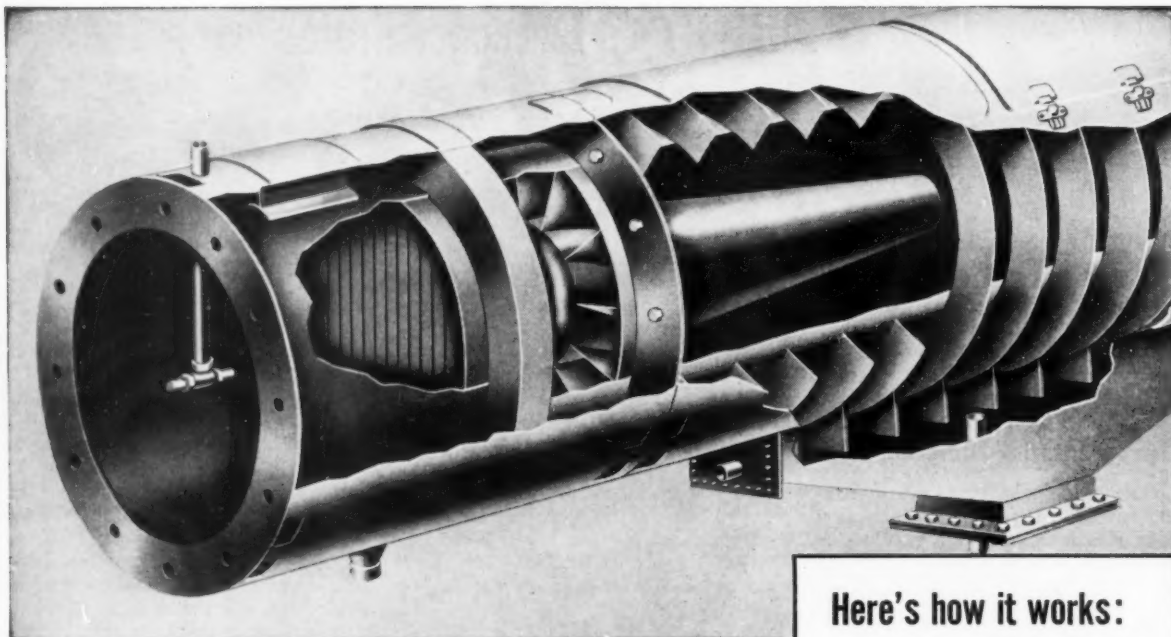
Export Problems Are Discussed by Mining Equipment Manufacturers . . .

Representatives of the mining machinery and equipment manufacturing industry met with Department of Commerce officials last month to discuss the handicaps encountered when attempting to expand export business. The meeting was one of a series the department has been holding

with key United States industries to develop measures which the government might take to aid in increasing exports.

Spokesmen for the mining machinery industry cited tariffs, quotas, licensing and exchange controls, and

government "red tape" encountered abroad in the processing of import licenses as the principal handicaps to foreign sales. They also noted that in some instances domestic concerns are able to hold foreign business only by setting up subsidiaries in other countries.



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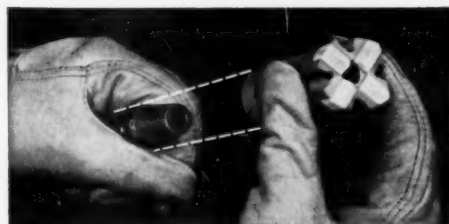
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This team of hard working Lima shovels speeds Mesabi Range ore loading. At left, $1\frac{1}{2}$ cu. yd.; at right, $3\frac{1}{2}$ cu. yd.

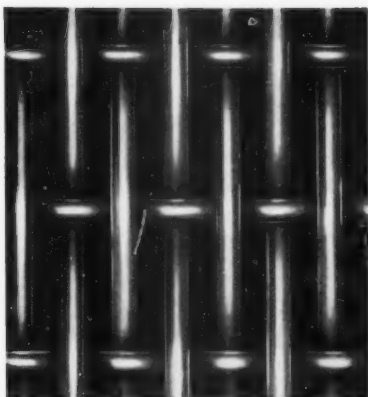
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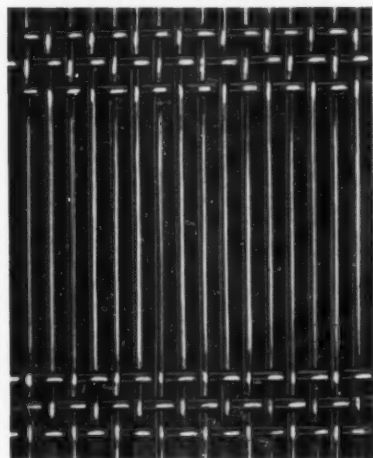
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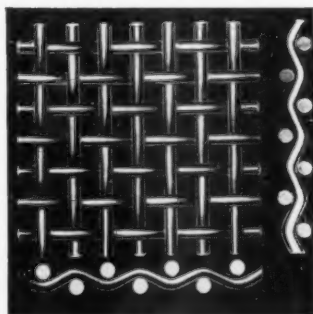




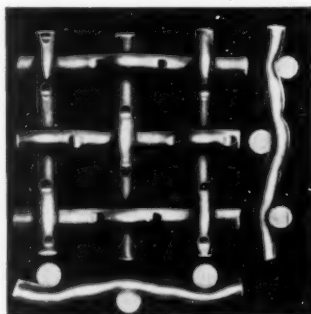
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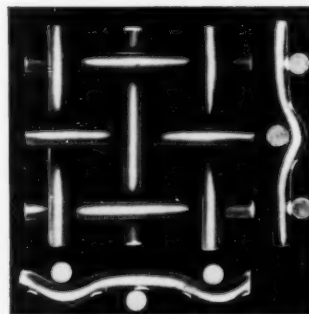
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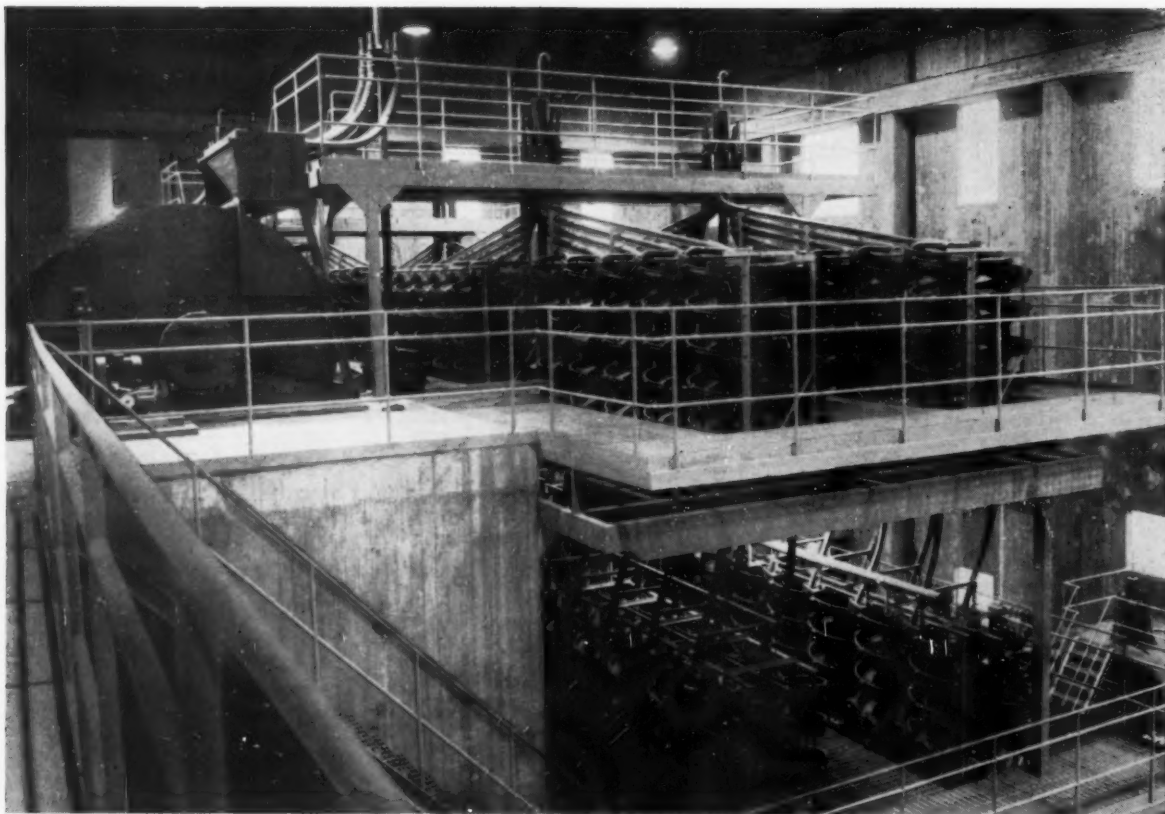
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See Featured Article on Pages 29, 30 and 31 of this Issue

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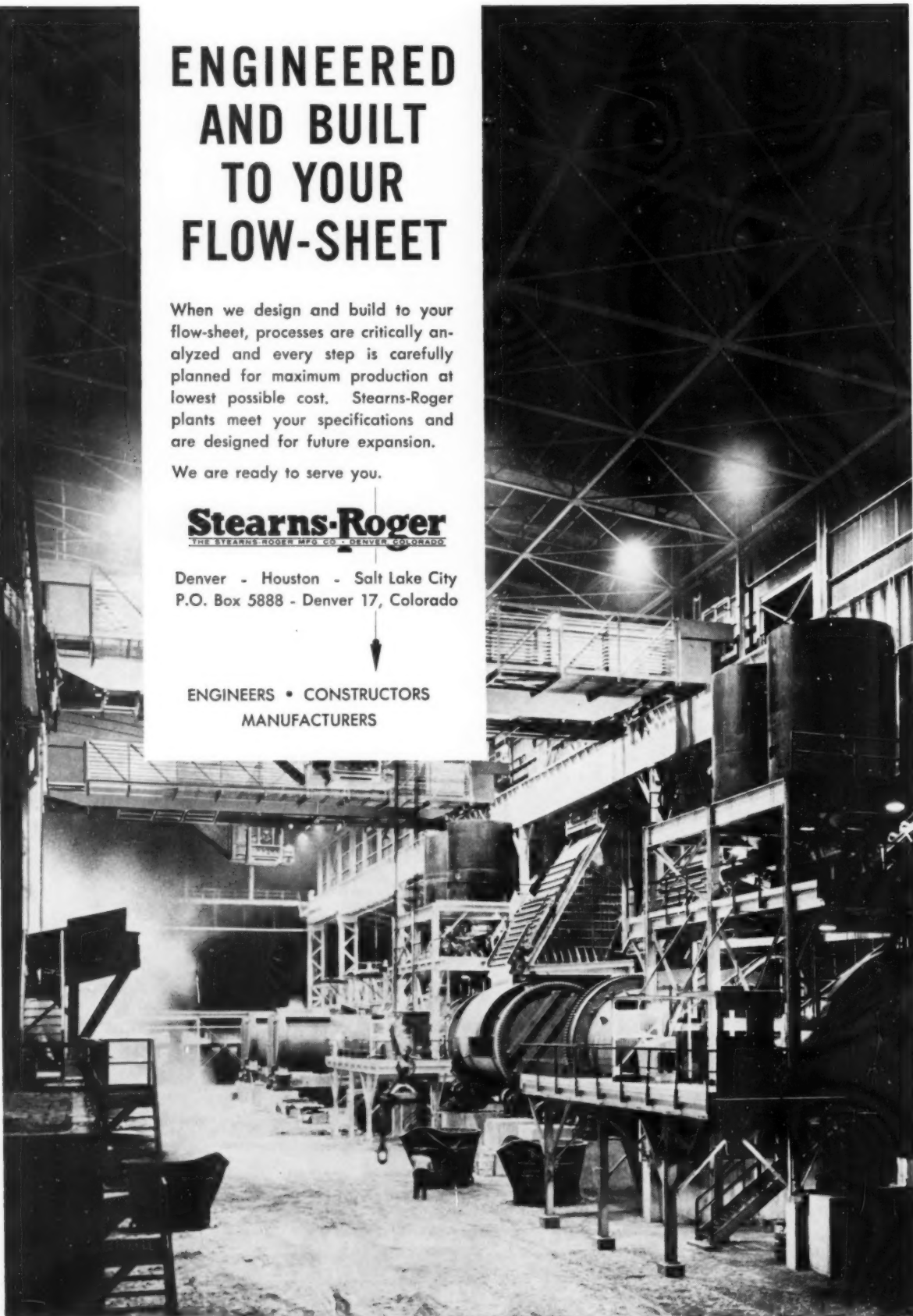
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Molybdenum Corporation Develops Low Grade Deposit

Exploration has confirmed the existence of a large, low-grade molybdenum deposit located on a property owned by the Molybdenum Corporation of America near Questa, New Mexico.

From June 15, 1957, to June 30, 1960, exploration work was carried out by the company with the financial assistance of the Defense Minerals Exploration Administration (DMEA), and a recent final report has disclosed a very considerable area of molybdenite mineralization. Indicated ore calculated from assays of drift and diamond drill samples is stated as 260,000,000 tons containing

about 0.25 percent MoS_2 per ton.

Additional exploratory work conducted by the company since June 30, 1960 has extended the area of mineralization and disclosed substantial zones of higher mineral content. Exploration activities are continuing, and additional drifting and drilling will be carried on to further define enriched zones. No decision on mining operations will be made until the conclusion of present work.

The Questa mine, where extensive exploration has been carried out for almost five years, is located in the heart of the Red River mining district of northern New Mexico.



AEC Commitments in U. S. Now Total \$1,552,800,000

The United States Atomic Energy Commission has released information concerning the 190,674,000 pounds of uranium concentrates to be purchased by the United States government through December 31, 1966.

The following table is a summary of the approximate quantities and

prices involved in 27 existing, outstanding contracts with domestic uranium milling companies. The contracts give the Commission the option of adding at any time specified quantities of U_3O_8 produced by independent mine operators from eligible

properties. The figures do not include additional purchases which will result from contract extensions yet to be negotiated. Likewise, the quantities indicated and total costs may be affected by failure of some mining properties to produce the requisite amount of ore to fulfill contracts.

Summary of Atomic Energy Commission's Uranium Purchase Commitments Through December 31, 1966 Under 27 Existing Contracts

Company	Mill	Daily Capacity In Tons	Pounds Pre-April 1, 1962	Value Per Pound	Pounds Post-April 1, 1962*	Total Sales Value Post July 1, 1962	End of Current Contract
Anaconda Company	Bluewater, N. M.	3,000	5,250,000	\$8.79	10,708,500	\$132,000,000	December 31, 1966
Climax Uranium Company	Grand Junction, Colo.	330	1,036,700	\$8.00	1,560,800	\$21,000,000	December 31, 1966
Cotter Corporation	Canon City, Colo.	200	898,000	\$8.62	1,503,100	\$20,000,000	February 28, 1965
Dawn Mining Company	Ford, Wash.	400	999,200	\$9.27	2,610,400	\$30,000,000	December 31, 1966
Federal-Radrock-Gas Hills Partners	Fremont County, Wyo.	520	1,363,200	\$8.15	3,700,200	\$41,000,000	December 31, 1966
Globe Mining Company	Natrona County, Wyo.	490	1,138,000	\$8.30	3,091,000	\$34,000,000	December 31, 1966
Gunnison Mining Company	Gunnison, Colo.	200	823,200	\$9.19†	2,05,800‡	\$9,200,000	December 31, 1962
Homestake-Sagin Partners	Grants, N. M.	1,500	4,020,600	\$8.00	10,680,000	\$118,000,000	December 31, 1966
Kerr-McGee Oil Industries, Inc.	Shiprock, N. M.	300	942,200	\$8.00	872,700	\$14,500,000	June 30, 1965
Petratomics Company	Shirley Basin, Wyo.	To be built	1,024,000	N.A.	3,158,800	\$25,000,000	December 31, 1966
Phillips Petroleum Co.	Grants, N. M.	1,725	5,861,700	\$7.75	13,345,500§	\$152,000,000	December 31, 1966
Susquehanna-Western, Inc.	Falls City, Texas	200¶	337,500	\$9.90	1,247,400	\$13,300,000	December 31, 1966
Uranium Reduction Company	Moab, Utah	1,500	6,175,500	\$8.15¶	14,773,000	\$169,000,000	December 31, 1966
Utah Construction and Mining Company	Freemont County, Wyo.	980	2,961,400	\$7.90	8,432,700	\$91,000,000	December 31, 1966
Western Nuclear Corp.	Jeffrey City, Wyo.	845	2,828,600	\$7.72	8,526,900	\$90,000,000	December 31, 1966
Homestake-New Mexico Partners¶	Grants, N. M.	750	3,459,600	\$8.31		\$29,000,000	March 31, 1962
Kermac Nuclear Fuels Corporation¶	Grants, N. M.	3,300	16,269,000	\$7.46	21,375,000	\$292,000,000	December 31, 1966
Lakeview Mining Company¶	Lakeview, Oregon	210	805,000	\$9.27	766,600	\$13,600,000	November 30, 1963
Mines Development, Inc.¶	Edgemont, S. D.	400	938,600	\$9.87		\$9,300,000	March 31, 1962
Rare Metals Corporation of America¶	Tuba City, Ariz.	300	1,096,000	\$10.70¶		\$11,700,000	March 31, 1962
Susquehanna-Western, Inc.¶	Riverton, Wyo.	500	1,435,000	\$8.74	1,298,300	\$22,900,000	October 31, 1963
Texas-Zinc Minerals Corp.¶	Mexican Hat, Utah	1,000	3,097,500	\$8.95	8,407,500	\$95,000,000	December 31, 1966
Trace Elements Corp.¶	Maybell, Colo.	300	1,255,500	\$9.29		\$11,700,000	March 31, 1962
Union Carbide Nuclear Co.¶	Rifle, Colo.	1,000	5,772,800	\$9.65		\$56,000,000	March 31, 1962
Union Carbide Nuclear Co.¶	Uravan, Colo.	1,000	2,490,500	\$9.65		\$24,000,000	March 31, 1962
Vanadium Corporation of America¶	Durango, Colo.	750	1,750,000	\$8.02		\$14,000,000	March 31, 1962
Vitro Chemical Company¶	Salt Lake City, Utah	600	1,403,100	\$9.69		\$13,600,000	March 31, 1962

* Generally \$8.00 per pound. † To July 1, 1962. ‡ July 1 to December 31, 1962, \$8.00. § \$7.96 due to stretch-out. ¶ Under construction. ¶ Current price.

¶ Contract under review. N.A. Not Available.

Mining Wet Sandy U_3O_8 Ore

To reach high grade ore horizons, Utah Mining had to battle excess water and loose sand at Shirley Basin, Wyoming

If the Ambrosia Lake miners think they have it tough, they should see the sandy soup that is being handled by the Utah Mining Corporation at Shirley Basin, Wyoming. Here, underground workings are timbered continuously with close square sets and tight lagging to prevent dangerous sand runs. Spiling is driven at most working faces. Over 7,000 gallons of water a minute are pumped to the surface to keep the water table below the working level—and even with this, perched water zones are still bothersome. This really makes rugged working conditions and expensive mining. However, high grade uraninite ore, averaging about 0.6 percent U_3O_8 , is mined at the rate of 140 tons a day in spite of the many handicaps. This is the first producing mine in Shirley Basin, and being the pioneer, it is the first operation there to cope with the problems of mining in fine, wet, unconsolidated sand.

Claim rush climaxed discoveries

The Shirley Basin uranium district is located in Carbon County about 65 miles south of Casper, Wyoming, and has attracted national attention due to the high grade tenor of the ore horizons. The Shirley Basin story began, however, in 1954 when the

Teton Exploration Drilling Company of Casper, Wyoming, discovered uranium and staked claims. Other companies came into the area, and in July 1957, Shirley Basin experienced a claim-staking rush. At that time, Utah Construction and Mining Company, Subsidiary—Utah Mining Corporation, Kerr-McGee Oil Industries, Shoni Uranium Corporation, Tidewater Oil Company and others staked over 1,500 claims in a frenzy of activity. During two weeks in July, Utah Mining Corporation alone staked 400 claims. Immediately after staking, they initiated an intensive drilling program, which by the end of 1959 totaled over 400,000 feet representing some 1,000 drill holes. Because of this speed, Utah Mining was the first to block out ore reserves, and the first to get a production allocation from the Atomic Energy Commission. Thus, in 1959, the green light was given to go ahead with development and mining.

Geologic studies showed that the Shirley Basin uranium mineralization occurs in the Wind River formation of Tertiary age. This formation dips to the north, and is composed primarily of coarse to fine arkose sand horizons interbedded at irregular intervals with thin lenses of sandy to

silty clays. The basal member of the formation is considered to be a thick clay seam, and most of the known uranium mineralization is found in coarse, highly unconsolidated sand layers immediately above this clay. These mineralized, lenticular sand beds are known to occur over a distance of some 13 miles in a north-south direction in Shirley Basin.

Underground mining only possibility

Exploration and development drilling by Utah Mining indicated mineralization to be highly continuous, and under approximately 300 to 400 feet of overburden. Lithologic studies comparing Shirley Basin sedimentation with Gas Hills supported the view of ore continuity. Further work and comparisons indicated that ground support for any underground operations should be at least as good as in Gas Hills where hard clay lenses often required extensive blasting.

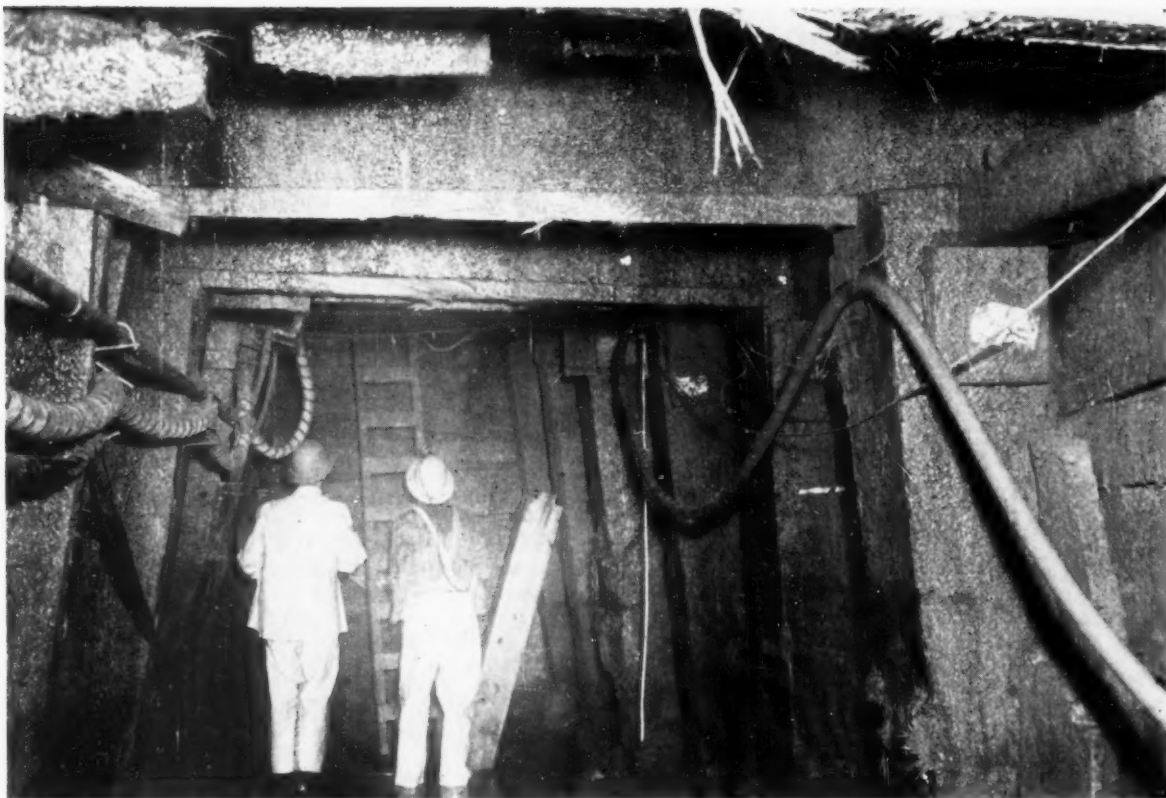
The Utah Mining Corporation received only a small allocation from the Atomic Energy Commission in January 1960. Accordingly, because of the high stripping ratio and the small yearly tonnage to be mined, underground mining methods were necessary. Therefore a shaft site was picked near the edge of the largest



SPILING is driven at working faces for support and safety. Stoper is used here to drill some hard clay.



WELLS containing submersible pumps have lowered the water table by pumping over 6,500 gallons of water a minute.



TIMBER SETS are five feet apart with lagging between to prevent sand runs. Small white tag nailed to each set is ore

grade. Perched water makes wet working conditions so that the mine has to pump up to 200 gallons of water a minute.

ore body, and at the low point of the main ore lense.

Shaft sinking hampered by water

Construction of surface facilities began in June 1959 and shaft sinking started in August. An all-steel head-frame was built and erected by the Mountain States Steel Company of

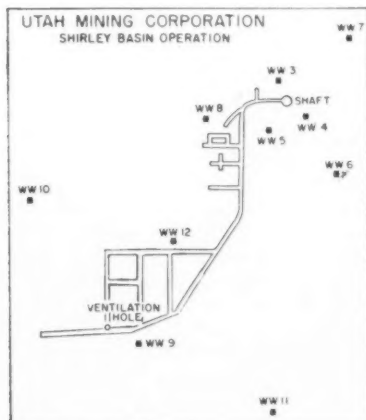
Provo, Utah. It is 75 feet high and completely covered against the 40 degree below zero winters. Adjacent surface buildings, including offices, change room, maintenance and repair shops, compressor and hoist rooms were built at the same time.

Shaft mucking was done with a Cryderman shaft sinker. The circular

12½-foot inside diameter shaft was sunk with a 12-inch minimum reinforced concrete lining. It contains two 5- by 6-foot compartments, plus a pipeway and manway.

In anticipation of water problems due to the high water table, two 20-inch diameter wells were drilled 35 feet on either side of the shaft. A 75 horsepower Byron Jackson submersible pump rated at 600 gallons per minute with a 400 foot head was installed in each of the holes to draw down the water table. As the shaft deepened and water became more of a problem, additional wells were drilled and pumps placed.

Shaft sinking progressed rapidly until excessive water was encountered at 160 feet—60 feet below the normal water table. At this point progress slowed because an outside ring of spiling was required to hold out the sandy, soft running ground, and the concrete lining was being placed with 12-foot pours rather than the previous 18-foot pours. Work then continued slowly down to 330 feet where a pumping station was cut. At this point attempts were made to seal off the heavy water flow by chemical grouting, but without success. Fin-



MAP showing underground workings and wells around periphery of ore body.



LOWERING casing down completed well. Wells average 460 feet deep.

They know how to handle wet ore . . .



JACK BAILEY (left) is manager of Shirley Basin operations for the Utah Mining Company.



MACK TILLEY, (right) who assisted with early shaft sinking, is now mine superintendent.

ally, at 365 feet, when nearly 3,000 gallons per minute were being handled and the excessive pumping was causing the sand to erode rapidly, a concrete plug was placed to seal the shaft. This concrete plug was placed on December 30, 1959, just a few feet above the thick basal clay seam which was the goal of the shaft sinking.

By this time several wells had been drilled, and continuous pumping was steadily lowering the water table and depleting the water reservoir that was feeding the lower sand beds. It was considered to be only a matter of time (a year or so) before shaft sinking and subsequent development could be resumed. Accordingly, it was decided to develop the upper ore horizon by drifting from the pumping station at the 330 level.

Today, a total of 12 wells has been placed around the periphery of the ore body to lower the water table. All of these are rotary drilled 20-inch holes and average 460 feet deep. Steel casing of 12¾-inch inside diameter has been placed in each of the holes and gravel packed. All the wells contain 75 horsepower Byron Jackson submersible pumps that pull over 6,500 gallons of water per minute, and have now lowered the water table from 100 feet to about 360 feet. Additional wells are to be drilled and water pumped until the water table is lowered to the top of the impervious clay seam at approximately 390 feet.

Square sets with lagging

The development of the 330 level has been highly successful considering the difficulties of working in wet, unconsolidated sand. Although the active water table has been lowered below this level, perched water zones continue to make wet working conditions as they drain. Thus, 150 to 200 gallons of water per minute must be pumped out of the shaft.

Development consists of one timbered drift about 1,100 feet long with several sub-level square set drifts and crosscuts. All drift sets are made of 12- by 12-inch fir timbers with 3- by 12-inch lagging used to prevent sand runs. The sets are spaced five feet apart, with a 7- by 9-foot inside dimension. Development sub-levels are driven with 5-foot center square sets using 8- by 8-inch fir timber, 3- by 12-inch back spiling, and 2- by 12-inch lagging. At places, development is three sets high, or about 18 feet. All openings made above the timbered drifts are cribbed tightly to prevent ground movement.

A 330-foot ventilation and exit escape hole has recently been completed 900 feet southwest of the shaft. This 20-inch diameter hole was rotary drilled, and steel cased to 30 inches with concrete packed around the outside of the casing. A steel ladder is used with small landings installed every 20 feet of vertical distance.

Equipment in the mine consists of Eimco model 12B and model 21 mucking machines, 17 horsepower air-driven Joy slushers working in scam drifts, 5 horsepower air-driven Gardner-Denver slushers in the stopes, Greensburg battery-powered 5-ton locomotives and 1½-ton Mancha trammers pulling C. S. Card 40 cubic foot solid-body ore cars. Excavation is done with Ingersoll-Rand model 59 and Gardner-Denver model C27 clay spades, and Ingersoll-Rand model 38 stopers with rotation palls removed. In order to further outline ore limits and provide water drainage, a longhole drilling program is carried on with a Thor air motor mounted on an air leg using light, tubular drill steel, "fishtail" bits, and a wet spindle. Where harder clay and compacted sands are encountered, an Atlas Copco BBD50 rockdrill and air leg is used with 7/8-inch sectional steel.

Atlas Ammonium Amodite powder

using electric blasing caps has been used on the job to date. However, since little blasting is required, only approximately three tons of powder have been needed.

Ore production began in March 1960, and has been largely from drift or sub-level headings. However, a modified long wall retreat method of stoping is in operation using 5-foot center square sets of 8- by 8-inch pine timber with 3- by 12-inch spiling required to hold the back. Mining thicknesses of from 3 to 20 feet are worked with little dilution. Experience is showing that at best only two rows of square sets can be held open for mining, with timber being pulled behind the retreating face to bring down the back.

Daily production is 140 tons

Beta Gamma rate meters installed by Blackwell Electronics of Denver, Colorado, are used in the mine for ore analysis. These special 110-volt instruments eliminate the background count and are calibrated for direct reading of ore values. All working faces are sampled each day, and the ore grades nailed to timber sets on small white tags.

To prevent dilution and packing of the sticky ore, daily production is handled only once underground. The solid body ore cars are caged to the surface by special C. S. Card skips that automatically dump the cars at the headframe. A small drying area and stockpile are located nearby. After sampling, 25-ton dump trucks haul the ore 150 miles to the Lucky Mc processing mill in the Gas Hills.

Production from the mine is about 140 tons of ore per day. Low grade development ore is stockpiled separately on the surface for possible future processing. Mining costs have been high, but with better methods, trained crews, and improved engineering control, these costs are being reduced.

Shirley Basin is one of the richest uranium provinces in the world, and this is being proven by the Utah Mining Corporation. In their mine areas have been sampled assaying over 1.0 percent U₃O₈, and assays up to 12 percent are not rare. However, the success of this rich property, and perhaps of Shirley Basin as a whole, is a tribute to the late Homer Mann who, as assistant manager of exploration for the Utah Construction and Mining Company, was largely responsible for its discovery and development. Today, the staff in direct charge for the Utah Mining Corporation consists of J. H. Bailey, manager of Shirley Basin operations, and M. M. Tilley, mine supt. END

RAYCO DRILLING CO. PROGRESS DATA DRILLING & CASING VENTILATION SHAFTS FOR KERMAC NUCLEAR CORP.								
SHAFT NO. & SECTION NO	NO.1 SECTION 17		NO. 2 SECTION 33		NO.3 SECTION 24		NO. 4 SECTION 22	
HOLE DIAMETER - INCHES	12 $\frac{1}{4}$	44	12 $\frac{1}{4}$	44	12 $\frac{1}{4}$	44	12 $\frac{1}{4}$	44
HOLE DEPTH - FEET	841	822	700	668	705	664	713	688
ROTARY SPEED - RPM	60	10-40	80	20-40	80	20-40	80	20-40
WEIGHT ON CUTTERS - 1,000 POUNDS	10	10-40	10-30	20-50	10-30	20-50	10-30	20-50
DRILL ROTATING HOURS	65 $\frac{1}{2}$	283	37.5	154	34 $\frac{1}{2}$	154.8	51.75	260
DRILL PENETRATION RATE - FEET/HOUR	12.8	3.44	18.7	4.34	20.2	4.4	13.8	2.65
ELAPSED DAYS - DRILLING	4	21	2	9	3	12	3	14
ELAPSED DAYS - RUNNING CASING	1		1		1		1	
TOTAL DAYS REQUIRED FOR SHAFT	26		12		15		22	
CONTRACT COST (DRILLING & HANGING CASING)	\$39,400		\$32,000		\$32,900		\$33,000	

THESE FIGURES show why it costs less and is much faster to drill ventilation shafts at Ambrosia Lake than to sink or raise by other methods. The figures in the left hand row of the double

columns refer to the pilot holes while those in the right hand column give data for reaming to 44-inch diameter. These holes are only a start for larger holes to be drilled in future.

How Rotary Drilling Speeds Shaft Sinking

- Kermac Nuclear drills four shafts at Ambrosia Lake totaling 2,862 feet in 10 weeks. Average cost for drilling 44-inch hole and hanging 36-inch casing was \$48.00 per foot. In one shaft 56 feet was average daily sinking rate using special bit with 12 Hughes rolling shaft cutters in four rings

by Floyd Ray and Gerald O. Atkinson

Rotary drilling is a fast, economical, and effective method for sinking shafts in certain shales and sandstones. Evidence of this was recently shown when the Rayco Drilling Company, a Farmington, New Mexico, oil field contract drilling firm, used conventional oil field rotary drilling machines and drilling practices to sink four 44-inch diameter ventilation shafts to depths ranging from 668 feet to 822 feet.

The shafts were drilled for Kermac Nuclear Fuels Corporation in the Ambrosia Lake district near Grants, New Mexico.

Actual drilling time required on

each of the four shafts ranged from nine days to 21 days. Cost per foot of hole drilled with the rotary rig was approximately the same as the cost of similar shafts drilled by other methods in the area.

The shales and sandstones encountered by Rayco in the Ambrosia Lake district were similar to those with which they had had previous experience in the Four Corners area oil fields. Among those were the Mancos shale, a black shale with thin sandstone stringers; the Dakota formation, a sandstone with thin layers of carbonaceous shale; and the Morrison formation, the upper member of which is the Brushy Basin. The Brushy Basin consists of bentonitic claystone with a few sandstone lenses. All four holes terminated in the Westwater member of the Morrison formation; a sandstone which contains most of the uranium-bearing ore bodies in the district.

One of the first problems encountered by Rayco in drilling these shafts was that of keeping the holes vertical. To insure that each shaft would be vertical a 12 $\frac{1}{4}$ inch diameter pilot hole was first drilled. In so doing, deviation of the four holes drilled was kept within 30 minutes (5.88 feet from vertical at 700 foot depth). Because of the possibility of objects falling into the shaft while drilling, the pilot holes were drilled 25 feet below total depth to provide each shaft with a "junk basket."

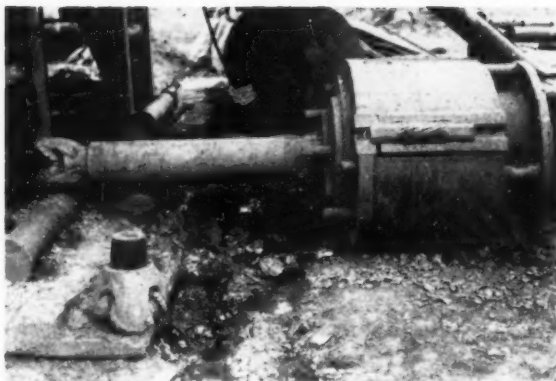
Drill Pilot Hole and Ream It

Following completion of a pilot hole the next step was to ream it to a full 44 inches. This was accomplished in one pass by using a bit body specially designed for this type of operation by the Hugh B. Williams Manufacturing Company of Dallas, Texas. Replaceable Hughes rolling cutters were used on the bit body

Mr. Ray is with the Rayco Drilling Company, Farmington, New Mexico, and Mr. Atkinson is with Hughes Tool Company, Houston, Texas.



SECTION 17 ventilation shaft was drilled first. Here is Rayco Drilling Company's Rig No. 3 making hole with big bit.



BIT BODY showing one of the side wall reamers and the stinger extending from bottom of body to follow pilot hole.



HUGHES rolling shaft cutters which were used to ream the 12 1/4-inch pilot hole to full diameter of 44-inches in one pass.

bottom. At the lower end of the bit body, a Hughes 12 1/4 inch "Tri-Cone" rock bit was used as a stinger to track the previously drilled pilot hole. To apply the necessary weight to the cutters, a 40-inch, lead-filled collar was fastened above the bit body. This particular collar was 8 feet 10 inches long and weighed 42,000 pounds.

For this project, the rotary speed was varied between 10 and 40 revolutions per minute, depending on the characteristics of the formation being drilled. Cuttings were removed by circulating 40-second Marsh viscosity mud through the drill pipe and discharging it at the face of the bit. The rising velocity in the annulus of the returning mud carried the cuttings to the surface and deposited them in a settling pit.

The casing used in lining these shafts was 36 inches in outside diameter with a wall thickness of 0.505 inch. Each joint was 38 to 40 feet long and weighed 192 pounds per lineal foot. As the joints were lowered into the hole, they were welded together by a team of three welders.

The sections of casing joints were aligned in a special welding fixture to assure concentricity between joints before welding.

Windows were cut in the lower sections of casing to allow water from the Westwater Canyon member to enter. This water was later drained when the underground mine workings advanced to a new shaft.

Of particular importance to the mine operator is that the method employed by Rayco in sinking these shafts was completely independent of the underground production workings. Also important is that all equipment used in the sinking of these shafts by the rotary drilling method was powered by internal combustion engines independent of the mine's source of power.

The low cost and short time that was required to complete this project for Kermac are most impressive. Rayco completed all four shafts, a total of 2,862 feet, in 10 weeks elapsed time. While this record is impressive, rate of penetration is certain to improve as more experience is gained. Also, the cost per foot

of hole for sinking these four shafts was approximately the same as the reported costs of any other shafts sunk in the Ambrosia Lake district. This cost, too, is expected to decrease with experience.

It should be mentioned that for this project Kermac furnished the 36-inch casing and excavated the mud and settling pits used in drilling the shafts.

Comparison With Other Methods

Previous to the completion of these four shafts by Rayco, primarily churn drills (cable tools) had been used to sink ventilation shafts in the Ambrosia Lake district. A comparison between the rotary drilling and churn drilling methods of shaft sinking shows that while the cost of a churn-drilled hole is approximately the same as the cost of a rotary drilled one, the time required to sink a shaft with a churn drill is considerably longer. While a rotary-drilled shaft can often be sunk in this area in less than three weeks, a churn-drilled shaft of the same diameter will require about three to five months to

$$H_f = \frac{kPLq^2 d}{5.2A^3.075}$$

WHERE:

H_f = PRESSURE LOSS DUE TO FRICTION IN INCHES OF WATER
 k = FRICTION FACTOR FOR AIR
 P = PERIMETER OF AIRWAY
 q = AIR FLOW RATE - CUBIC FEET PER MINUTE
 d = WEIGHT OF AIR AT EXISTING CONDITIONS
 A = CROSS SECTIONAL AREA OF AIRWAY IN SQUARE FEET
 L = LENGTH OF AIRWAY IN FEET

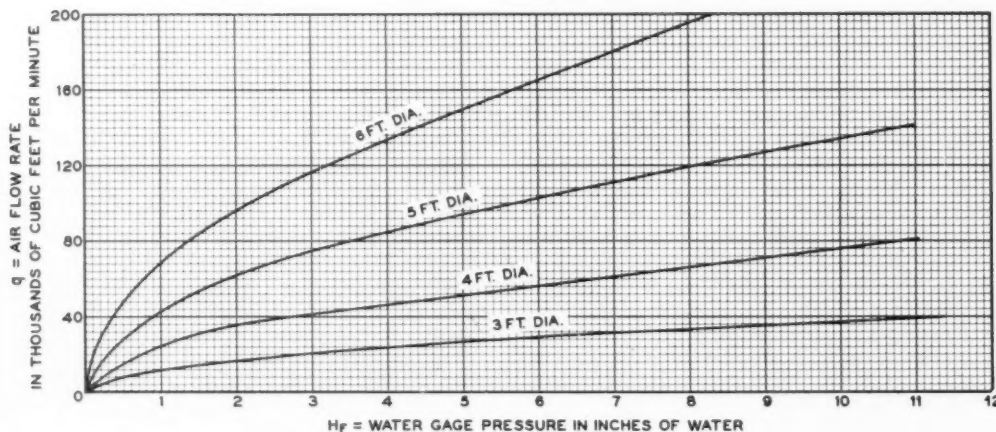
* U.S. BUREAU OF MINES
 BULLETIN 385

THESE CURVES ARE TRUE WHERE:

$k = 20 \times 10^{-10}$ - AIRWAY WITH
 SMOOTH WALLS

$d = .075$ - STANDARD AIR

$L = 700$ FT.



AIR FLOW VERSUS WATER GAGE PRESSURE shows the importance of ventilation through large shafts to achieve

low cost per unit volume of air moved. Figures in the text show how a more expensive shaft soon pays for itself.

complete. Also, a churn-drilled hole will quite often have a more disturbed and irregular wall than one which has been rotary drilled.

Data gathered during the Rayco job, and other information accumulated during the past several years, indicate that shaft sinking could be successfully employed in diameters much larger than those drilled for Kermac. Shafts seven feet in diameter have been sunk by the rotary method and it is felt that this size is not the maximum. Although the holes drilled for Kermac were in soft and medium hard formations, the rotary drills could be used equally as well in harder formations. The Hughes cutters are available for drilling in formation ranges from soft to extremely hard and can be installed quickly on the cutter plate to meet specific formation requirements.

Why Larger Shafts Save Money

It might be well at this point to look at the economics of two rotary-drilled shafts of different diameters to get an over-all view of the practicability of the rotary drilling method

in areas similar to the Ambrosia Lake district. As has been previously discussed, the 44-inch diameter shafts drilled for Kermac have 36-inch finished outside diameters through which Kermac plans to circulate 40,000 cubic feet of air per minute. A look at the curve in the graph, *Air Flow Versus Water Gage Pressure*, shows that to circulate this volume of air through the shaft, a water pressure of 11.3 inches is required. This resistance can be converted into horsepower and dollars per year. Assuming a kilowatt hour costs one cent, we find that the power cost of moving 40,000 cubic feet of air through a 36-inch diameter shaft for one year comes to \$4,700. This cost is approximated by the equation:

$$\frac{0.746 \times H \times Q \times 24 \times 365 \times 0.01}{6,350} = \$/\text{year}$$

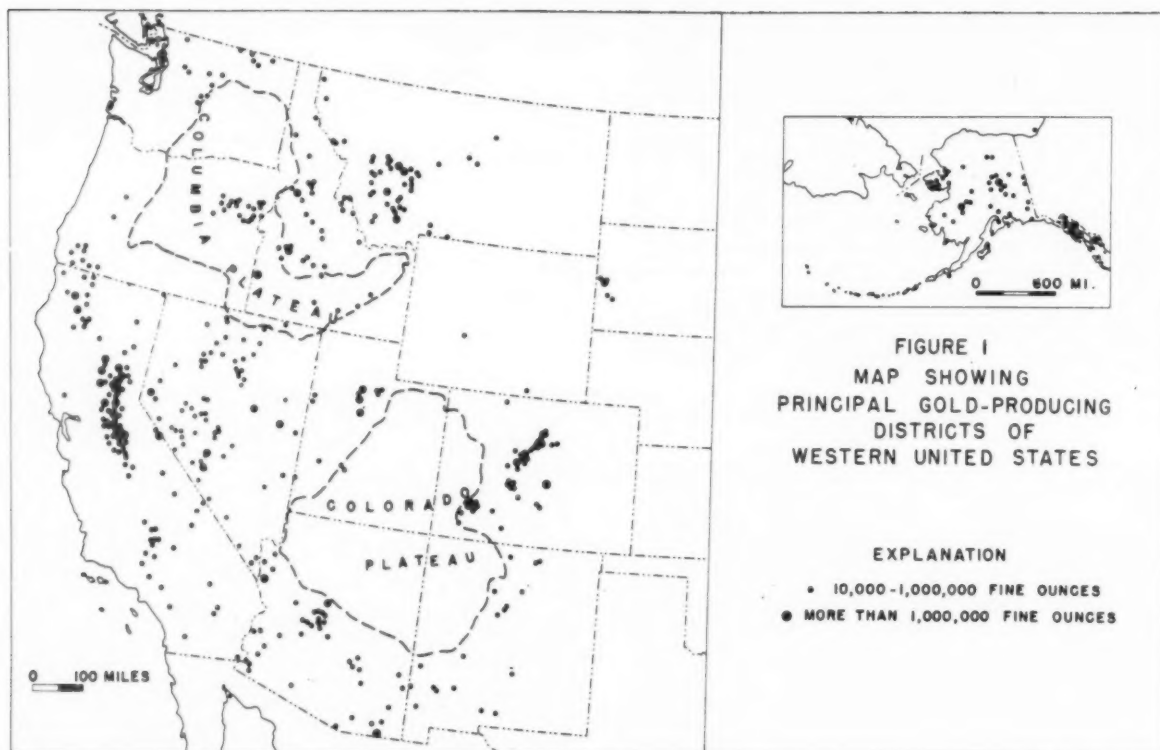
Wherein: 0.746 = Kilowatts per horsepower; H = Water pressure; Q = Quantity of air per minute; 24 = Hours per day; 365 = Days per year; 0.01 = Cost of a kilowatt hour; and 6,350 = Constant.

Another look at the water pressure curve shows that the water gage pressure loss for moving 40,000 cubic feet per minute of air through a lined 48-inch diameter shaft is only 2.8

inches. When we convert this into dollars per year we find the cost for overcoming friction in the 48-inch diameter shaft to be \$1,200. To sink a 52-inch rotary drilled hole in the Ambrosia Lake area will cost approximately \$60.00 per foot with the cost of 48-inch casing being about \$32.00 per foot. This gives an increase in shaft cost of \$18.00 per foot, or \$13,000 for a 700-foot shaft. In less than four years, the savings in power cost in moving 40,000 cubic feet per minute of air through the 48-inch shaft will pay for the increased shaft size.

We may look at the 48-inch diameter shaft in another way. Assuming the same power as used on a 36-inch shaft for circulating the 40,000 cubic feet per minute of air, we find we can circulate 62,500 cubic feet per minute of air through the 48-inch shaft. The volume of air has increased 56 percent while shaft costs have increased only 31 percent, and power consumption has remained the same. The resistance to flow of air

continued on page 55



MOST of the principal gold districts, shown on Figure No. 1, are not distributed at random throughout the country, but are concentrated in the mountainous areas of western United States, where faulting and igneous intrusions have disturbed and dislocated the rocks. Many large base-metal deposits, on the other hand, are found in the large relatively undisturbed areas of central and eastern United States. Gold is not even a byproduct of these base-metal ores. Within the western states certain physiographic provinces are barren of gold de-

posits, notably the Colorado Plateau, a large part of the Columbia Plateau and most of Wyoming. Among the ore deposits in disturbed areas of western United States the occurrence of gold is erratic and many rich deposits have yielded relatively little or no gold; foremost among these are the large silver-lead deposits of Coeur d'Alene, Idaho, Aspen, Colorado, and Magdalena, New Mexico; and the copper deposits of Morenci, Ray, Miami, and Superior in Arizona, and Santa Rita, New Mexico.

HOW ABOUT GOLD? where

With the nation's gold crisis making headline news around the world, it's time to take a good look at gold in the United States. This article summarizes briefly: 1. gold production and geographic distribution of gold districts; 2. trends of production; and 3. postulates from available data the potential gold production in the United States. Geological features of gold deposits will not be discussed.

Gold was first mined in the southeastern states beginning about 1792 (Loughlin, Ferguson, and others, 1929, Table I), but the bulk of the gold production has come from the western states, following the discovery of placer gold in California in 1848.

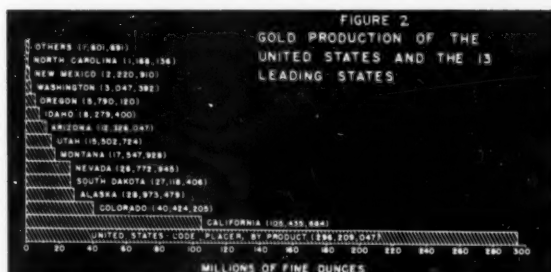
Exploration and mining activity boomed and production increased rapidly; in 1850 it reached 2,000,000 ounces and in 1853, 3,000,000 ounces. It then declined steadily and in 1862 again dropped below the 2,000,000-ounce level. Placers were the chief source of our domestic output until 1873 (Loughlin, Ferguson, and others, 1929), when they were exceeded by the output of lodes, a relation that has continued to the present. Placer production remained at a relatively low ebb during the 1880's and early 1890's, but there were several periods in later years when placer production, though exceeded by lode production, formed a significant proportion of the domestic output—in 1896 when large dredges were introduced in California, in 1904 when large deposits of rich gravels were discovered in Alaska,

and in 1934 when the price of gold was increased to \$35.00 an ounce.

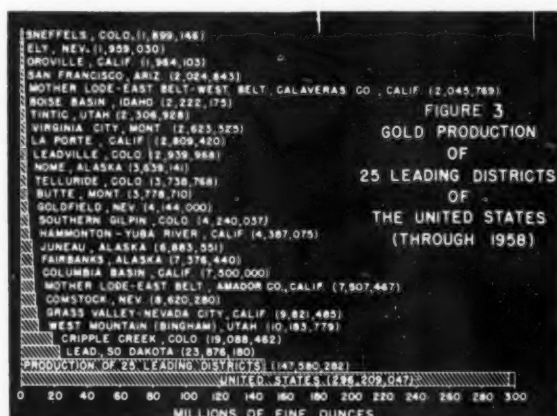
Most of the domestic gold output since 1873 has come from dry and siliceous ores. Lode mining began shortly after placer mining but it was not until about the middle 1860's, when the Mother Lode and Grass Valley lodes in California and the Comstock Lode in Nevada became important producers, that lode mines became significant sources of gold. Lode production increased rapidly following the discovery of gold in the Cripple Creek district in 1892, and by 1898 production from this district, together with the increased placer production in California, had raised our annual gold production to more than 3,000,000 ounces. Production continued to rise with the discoveries of Tonopah, Nevada, in 1903, the placer deposits of Alaska

1. Publication authorized by the director, United States Geological Survey.

GOLD is one of the most widely distributed metals in nature. It most commonly occurs in its native form and is easily recognized by its color and malleability. Three general sources of gold are recognized: (1) placers, (2) lodes in which gold is essentially the only metal present in economically valuable amounts (dry and siliceous ores), and (3) base-metal ores which yield gold as a byproduct. The United States has produced through 1958 about 296,209,047 ounces of gold, which, at the present price of \$35.00 an ounce, would be valued, in round numbers, at \$10,367,000,000, about one-half of the value of the present gold holdings of the United States government. Gold was first mined beginning about 1792 in the southern Appalachian states, but these deposits, though rich, were relatively small and were quickly depleted. The bulk of our gold production has come from the western states, including Alaska.



Production of the principal gold-producing states is shown graphically in Figure No. 2.



THE 25 most productive districts, listed in order of rank, and the total production of each through 1958, are shown graphically in Figure No. 3. These 25 districts have produced about one-half the gold mined in the United States.

In the United States, 505 districts have produced at least 10,000 ounces of gold apiece, and many more districts have a smaller production. Of the principal districts, 268 have produced between 10,000 and 100,000 ounces, 192 have produced more than 100,000 and 1,000,000 ounces, and 45 have produced more than 1,000,000 ounces. Three districts: Lead, South Dakota, Cripple Creek, Colorado, and West Mountain (Bingham), Utah, listed according to rank, have each produced over 10,000,000 ounces and Lead has produced over 20,000,000 ounces. The 505 principal districts are distributed among the states as follows:

California	95	Alaska	43	Washington	15
Nevada	70	Arizona	42	North Carolina	15
Montana	52	Idaho	39	Others	56
Colorado	46	Oregon	32		

mined and future production outlook

in 1904, and Goldfield, Nevada, in 1905. By 1905 gold production for the first time exceeded 4,000,000 ounces, a level maintained until 1917. Because of a shortage of manpower during World War I production then declined rapidly, falling almost to the 2,000,000-ounce level by 1920, where it remained until 1934. Many gold mines were reopened during the depression in the early 1930's. When the price of gold was raised in 1934 to \$35.00 per ounce, production increased rapidly and in 1937 again passed the 4,000,000-ounce mark. Additional gold was derived as a byproduct from increased production of base metals in the late 1930's, and in 1940 gold production reached an all-time high of 4,869,949 ounces. Shortly after the United States entered World War II, the gold mines were closed and gold production in

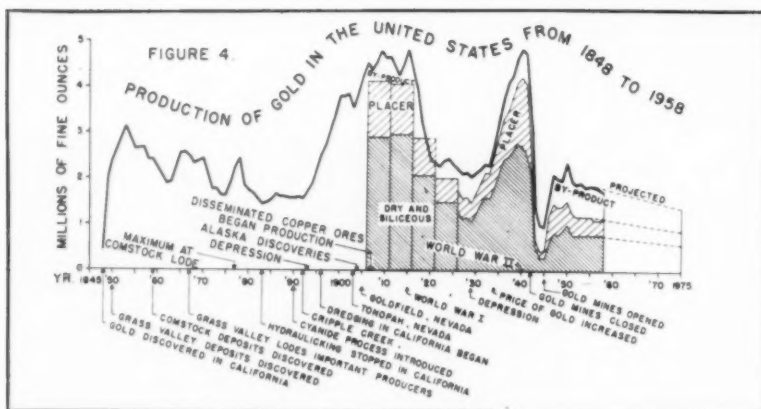
1944 and 1945 dropped below the 1,000,000 ounce mark, the lowest since 1849.

Until 1943 byproduct gold, obtained from base-metal ores, formed only a small, though significant, fraction of the total production of this country. Only in World War II (years of 1943-1945 inclusive), when base-metal production increased and gold mines were closed, did byproduct gold contribute more than 50 percent of our annual domestic production, and since 1951 it has steadily outranked placer production. Byproduct gold is recovered principally from copper ores, chiefly from porphyry copper ores, which began production on a substantial scale about 1907. West Mountain (Bingham) district, Utah, was the leading gold producer in the country in 1943, 1944, and 1945. In 1946 the Lead

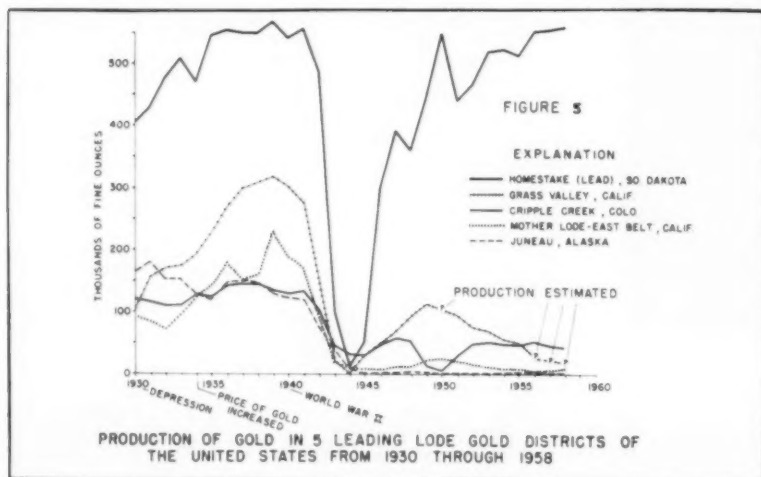
district, South Dakota, regained the lead, a position it has held since. The West Mountain district, Utah, has since held second place.

The gold mines were permitted to reopen in 1945, but in general the post-war economic boom has not been conducive to gold mining. Immediately after the war, gold production rose to 2,000,000 ounces, but increased mining costs combined with the fixed price of gold have provided little incentive to reopen many of the mines, and gold production has declined since 1951.

The prediction of future or potential production of a mineral commodity is generally based on estimates of its reserves. However, reserve data have been compiled for only a few gold deposits; for most of them our present knowledge and data are too scant to warrant reserve



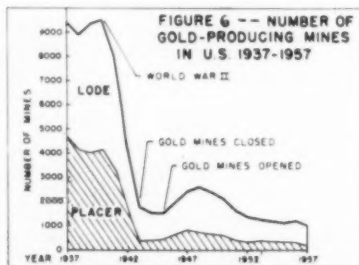
GOLD PRODUCTION in the United States has been affected by a number of factors: increases in production have resulted from new discoveries, technical advances in mining, milling, and metallurgy, and increases in the price of gold and of other metals from whose ores gold is derived as a byproduct; decreases in gold production have resulted from depletion of ores, increased mining costs, falling base-metal prices, and labor shortages. Figure No. 4.



ABOUT 400 of the 505 principal districts are at present either dormant or have an annual production of less than 100 ounces. Of the 25 leading districts listed in Figure No. 2, eight are dormant, five produce less than 100 ounces annually or have sporadic production, and only 12 maintain activity comparable to that of the prewar period.

The Lead district (Homestake) is steadily increasing its production and stands in marked contrast to the shrinking output of the other four leading districts, as shown in Figure No. 5.

TREND IN TERMS of active mines that produced gold from 1937 through 1957 is shown in Figure No. 6. In 1940, when gold production reached an all-time high, a total of 9,569 mines produced gold and silver, of which the vast majority were gold mines. During the war years, 1943-1944-1945, the number of producing mines dropped to a low of 1,552 mines. The placer mines dropped from a high of 4,699 in 1937 to a low of 362 in 1943, and lode mines dropped from a high of 5,393 in 1940 to a low of 1,112 in 1945. After the war, 778 placer mines were reactivated by 1947, but the number declined and reached a



low of 228 in 1957. Lode mines present a comparable record, rising to 1,961 in 1948, but then declined to 830 in 1957.

estimates. Therefore, potential production will be estimated in terms of probable production over a period of years, using, as a basis for extrapolation, productions trends that have obtained since the end of World War II.

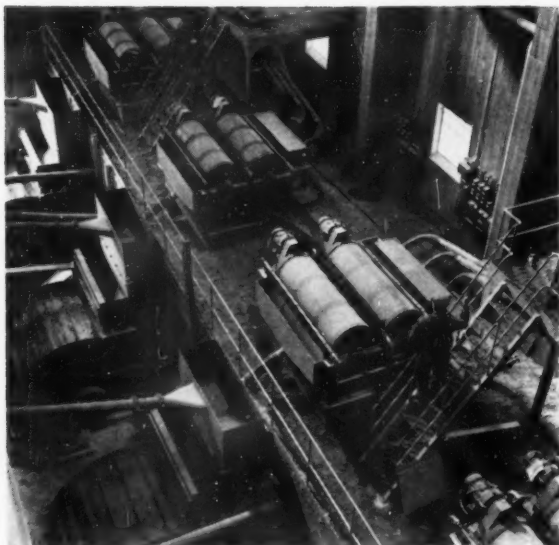
Figure No. 4 shows graphically the annual gold production in this country. In the post-World War II period from 1947 to 1958, production shows a slight annual decline. Assuming that present economic conditions continue, projection of this portion of the curve into the future should give a reasonable production trend. Figure No. 4 shows such a projection, and indicates that our annual production by 1975 will probably decline to about 1,400,000 ounces. The main factors that are effecting a decline in production are the fixed price of gold, increasing mining costs, and gradual depletion of our lode and placer deposits.

Byproduct gold has constituted an increasingly large part of the total domestic output, mainly as a result of copper mining and, in late years, has been between 600,000 and 700,000 ounces. Consequently, any change in production of base-metal ores, particularly those of copper, will exercise a corresponding effect on the production of gold. Should base-metal production decline, annual production of byproduct gold will probably drop to 500,000 ounces or less.

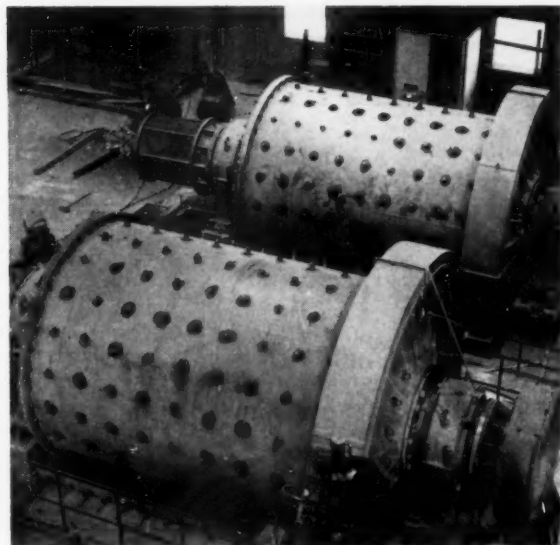
Any significant increase in production of gold in the United States will depend on (1) an increase in the price of gold, (2) greatly improved mining and metallurgical techniques for the treatment of low-grade ore, or (3) an increased production of base-metal and silver ores that yield byproduct gold. Some of these possibilities materialized in the 1930's, and gold production reached its all-time high.

Most of the gold mines that were active prior to World War II were not reopened after the war. Many mines failed to reopen because of excessive mining costs, and not primarily because the ore was depleted. The many inactive mines must be considered potential producers if and when economic factors again become favorable. Lower mining costs and improved techniques would tend to increase production but would benefit mainly the operators who mine large low-grade deposits, rather than the hundreds of small producers. Obviously, the amount of a price increase would determine the increase in production, and under most favorable circumstances, as in 1940, production could again reach the 4,000,000 ounce level.

END



TWO STAGE magnetic separation using Gröndal type separators with permanent magnets make a 63 percent concentrate.



SINGLE STAGE grinding is done in these Marcy 9- by 12-foot rod mills to liberate iron minerals at minus-8-mesh.

Magnetite-Hematite Ore Concentrated With Separators and Spirals at New Swedish Mill

A new magnetic and gravity concentration mill treating a mixed magnetite-hematite ore is now producing 300,000 tons of high-grade iron concentrate per year in Sweden's Risberg field, Grängesberg.

The new Risberg mill, operated by Stora Kopparbergs Bergslags Aktiebolag, produces about one-third the sinter feed requirement for the company's Domnarfvet Jernverk pig iron blast furnaces.

An extensive metallurgical test program to determine the best method of concentration was undertaken before the new mill was built. Magnetic separators proved the obvious and logical choice for magnetite concentration. Tests for recovering the hematite portion were made with shaking tables, cyclones, flotation, and Humphreys spirals.

Metallurgical results of these tests are shown in the accompanying table. Test results indicated that flotation yielded the highest concentrate grade and iron recovery. However, this method is expensive in comparison with spirals. In addition, flotation necessitated grinding to minus-60-mesh which produced a concentrate which is extremely hard to sinter.

These tests and a cost evaluation of their results dictated Humphreys spirals for recovering hematite in the Risberg ore.

Ore for the new mill is mined from several steeply dipping ore bodies adjacent to the well-known Grängesberg field, which is central Sweden's largest iron ore deposit. The ore, which is high in phosphorus, is a coarse-grained mixture of magnetite and hematite with narrow intermediate layers of lepidolite. Numerous pegmatite veins cut across the deposit.

by **Sven E. Sjöberg**

Assistant Manager, mining dept.
Stora Kopparbergs Bergslags, A. B.
Falun, Sweden.



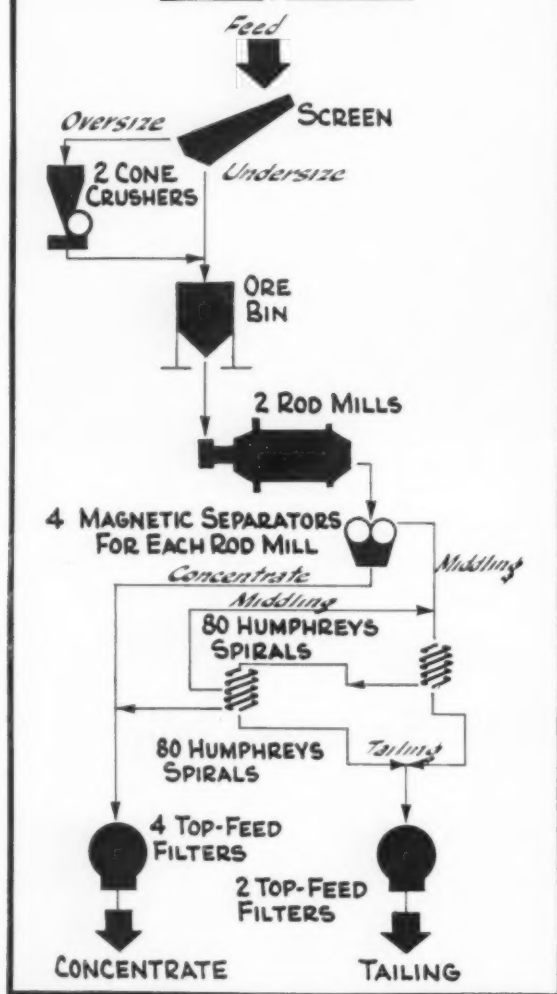
Mr. Sjöberg has been employed by Stora Kopparbergs since receiving his mining engineer's license in 1943. He was appointed superintendent of the Vintjärn iron mine in 1946, and the Tuna Hästberg iron-manganese mine in 1950. Since 1952 he has held his present position with Stora.

All ore is crushed underground to minus-10-inches in a Morgårdshammar AR-150 jaw crusher. Crushed ore is collected in a skip pocket of 2,000 tons capacity. The skip loader regulates hoisting by a push button control system.

The ore is hoisted and dumped into the headframe bin which holds 1,500 tons. From this bin it is drawn out and dumped into the top of a 7-foot standard Symons cone crusher for second stage crushing.

The third stage crushing, in two Symons 5.5-foot short head crushers, is done in the main concentrating building. Ore from second stage crushing in headframe building is transported to concentrator by a 100 meter long conveyor belt. The belt discharges to a vibrating screen. Minus-1-inch ore drops into the fine ore bin and the

RISBERG IRON CONCENTRATOR FALUN, SWEDEN



MINE AND MILL PLANT with change house, concrete headframe and secondary crushing, ore conveyor, and the concentrator building. Note clean functional lines of buildings.

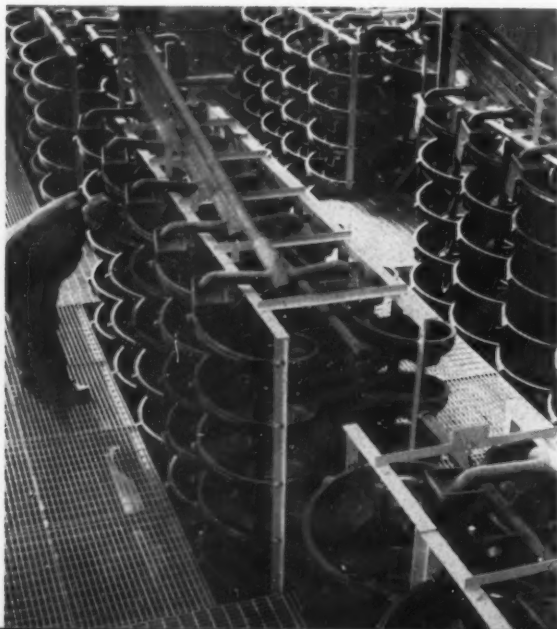
oversize fraction is split to the two short heads with crusher discharge dropping directly into bin.

The main concentrating building is 20 by 40 meters in area. The exterior walls are reinforced concrete with a new type of insulation incorporating wooden wool panels.

A special feature of this building is the use of structural steel for machinery foundations. This will permit easy relocation or addition of new equipment at any time in the future when the present flowsheet is modified.

Crushed ore, 150 tons per hour, is fed to two 9- by 12-foot Marcy rod mills by two parallel feed conveyors under automatic control. In the rod mills the ore is reduced to minus-8-mesh and is then fed to magnetic separation—two stages on four parallel sets of separators. The separators, of the Gröndal type, are 6 feet wide and are fitted with permanent magnets.

The magnetic concentrate contains about 65 percent Fe and is fed directly to one of four filters. The nonmagnetic fraction is collected in four surge tanks, from which it is pumped to another section for treatment with



HUMPHREYS SPIRALS

There is no classification of feed. This is not considered desirable since the fine grain sizes constitute a certain wear protection and also ease the passage of the coarser sizes, without lowering the ratio of concentration. However, on the other hand there is no appreciable upgrading of particles of minus-200-mesh size.

Pulp density of the feed reaching the spirals must not exceed 30 percent solids, being preferably kept around 25 percent.

Floor levels must be so arranged that the operator can observe the operation of the upper spiral turn without climbing. See adjacent photograph.

In a spiral plant it is important that the different products be collected in troughs of sufficient size to prevent any spilling or splashing down to the underlying floors. The troughs should be rubber sheathed. Suitable bottom

Metallurgical Results of Risberg Iron Ore Concentrator, Sweden

Product	Tons Per Hour	Percent Iron	Percent Phos- phorous
Total feed	150	45	1
Spiral feed	80	30	—
Magnetic concentrate	70	63	—
Spiral concentrate	30	63	—
Total concentrate	100	63	—
Tailing	50	7 to 8	2

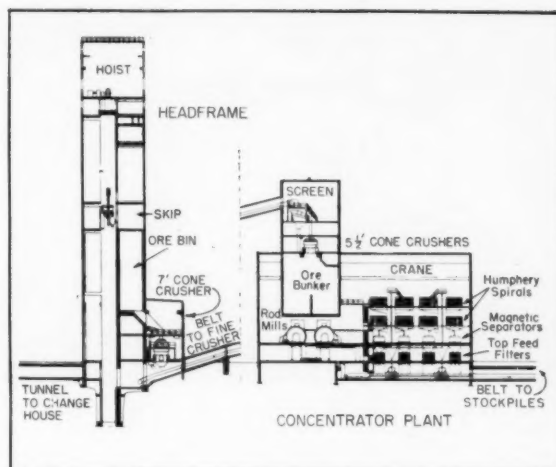
Results of Risberg Concentration Tests Showing Iron Assays in Percent

Product	Shaking Table	Cyclones		Flo- tation	Spirals
		Magne- tite Medium	Ferro- silicon Medium		
Feed	35	45	44	19	26
Concentrate	63	58	55	67	63
Tailing	14	33	8	2	10

Humphreys spirals. Here, the pulp is distributed over 80 five-turn spirals which produce a rougher concentrate and final tailing. The rougher concentrate from each five-turn spiral flows, after dilution with water, to a three-turn spiral immediately below for cleaning. This stage yields finished spiral concentrate, which drops to the filters and is mixed with magnetic concentrate and middling. This latter is returned to the rougher spirals via the surge tanks for nonmagnetic material.

The concentrate is dewatered on four parallel-mounted filters and then transported, first on a 270-meter long fixed belt conveyor and next to a 150-meter long shuttle belt conveyor, for distribution to the stockpile yard which will be able to hold a full year's production, i.e. 300,000 tons of concentrate.

The tailing is dewatered in two filters, from which the sand drops directly into two bins, each of 1,000 tons capacity. The tailing is then transported by truck to selected dumps. The trucks are loaded directly from bin bottom chutes. Tailing is used as filling material, also to



COMPACT DESIGN is feature of new Risberg headframe, crushing plant, and concentrator. Placing the secondary crushers on top of fine ore bin eliminates one bin and one conveyor.

a certain extent as road surfacing material, and as sand for concrete mixing.

The mill flowsheet is very simple; a great simplification in comparison with the accepted iron ore dressing practice in Sweden of only 10 years ago. Planning was based on the assumption that, if the products were not to include lump ore, then the complication of a cobbing stage prior to concentration could be dispensed with and the plant designed exclusively for the finished concentrate. This objective has been achieved in the design of the huge taconite mills built in recent years in Minnesota, which have in several respects been adopted as models for the new mill at Grängesberg.

Concentrate and tailing are dewatered on top-feed filters, and we believe that this is a good solution to the problem of high efficiency dewatering of coarse-grained products. Each filter has a capacity of up to approximately 40 tons per hour when dewatering to 7 or 8 percent water. All water is reclaimed and recirculated. No slime water is run off.

—tips on how to install and operate

inclines are 1:12 for tailing, 2:12 for middling, and 3:12 for concentrate.

To obtain the best result from a spiral plant, feeding must be as regular as possible. Uneven rates of material delivery may be evened out by collecting the feed in fairly large surge tanks.

The splitters at the concentrate ports must obviously be set with great care. When a spiral plant is first started, one pair of spirals is adjusted as accurately as possible and angle gauges are calibrated from this pair. The angle gauges are then used to set the other spirals to the same concentration stage. The gauges are also used when one of the spirals is exchanged. The spiral operator is forbidden to alter the split angle without authority. One man per shift operates the spiral department.

The principal costs in spiral ore dressing are maintenance and replacements due to wear. Kopparbergs uses

cast iron spirals, the trouble-free life of these being about six months on an average. It is intended that rubber-lined spirals will subsequently be adopted and it is calculated that these will give five years' trouble-free operation.

Cast iron spirals are repaired by pasting on thin ribbons of Linatex, which does not appreciably affect the result of concentration since wear arises practically exclusively in the tailing part of the spiral turn.

When calculating the space required for a spiral plant it may generally be assumed that the capacity per spiral is 1.5 tons per hour, and that each spiral requires 1.0 square meter of space. A shaking table plant of corresponding capacity requires 10 times as much floor area and, furthermore, involves considerably more expensive building structures, as the dynamic stresses of the machines must be absorbed or counteracted.

END



SILVER BOW CREEK in Deerlodge Valley, receives all waste water from the Butte mines and Anaconda plant.



SETTLING POND where soluble iron in Silver Bow Creek water is precipitated out by lime in mill tailing water.

How Anaconda Handles Waste Water

The fresh water of rivers and streams is one of the great natural resources of our nation. To assure a continuing abundance of this valuable water, the mining industry takes positive steps to see that waste water from their operations does not affect the great natural waterways of our land. To this end, mines, mills and smelters often take elaborate precautions to keep rivers and streams fresh and clear.

Over the years The Anaconda Company in Montana has been particularly vigilant, and has gone to great lengths to see that their waste mine and tailing water does not adversely affect the streams in Deerlodge Valley. Recently they have expanded their water purification program to further insure downstream users palatable and potable water from Silver Bow Creek.

At the Butte operations of Anaconda, water is pumped from the underground mines up the High Ore shaft, and after running through a copper precipitation plant is discharged as a small tributary stream. This, plus other run-offs from the Butte area, forms the Silver Bow Creek to the south of the town in the Deerlodge National Forest.

Water from the Butte mines contains a lot of iron in solution in the form of ferrous sulphate. Downstream at

Anaconda, where the Anaconda Company maintains its concentrators and reduction plants, efficient tailing ponds absorb most of the waste water. However, water that does percolate through the tailing dams contains a high percentage of lime that was added in the flotation circuit. Rather than contaminating Silver Bow Creek, this "high lime" tailing water neutralizes the ferric hydroxide in the water. Thus Anaconda has the unique situation in which water from their mill flowing into Silver Bow Creek actually improves and restores the stream water.

In order to assist and promote this process, Anaconda dammed the Silver Bow and built a large settling pond several years ago. Called the Warm Springs River Pond, it covers an area of over 40 acres and at the earth and stone dam is about 18 feet deep. Here, the soluble iron and accumulated fine silt have ample time to settle out with the help of the lime content of the incoming tailing water.

For nine months of the year this system adequately purifies Silver Bow water. However, during April, May and June the creek is in flood stage and the volume of water increases three or four times. During these months not enough "high lime" tailing water is discharged into the creek and settling pond to precipitate out all the soluble iron. Thus, at this time, it is necessary for Anaconda to add more lime to the water. This is done above the settling pond where a wheelbarrow load of slaked lime is added to the water every 20 minutes during flood stage weeks.

At the pond affluent, below the dam and settling pond, the refreshed water of Silver Bow Creek is continually tested for pH. Here, at a station house, pH electrodes are kept in the water, floating on a small wooden boat and connected to a circular recording chart meter in the building. The chart meter is serviced daily and a permanent record kept of the pH of the water. During the winter months when the affluent is frozen over, water is continually pumped through the station house and the pH readings taken inside.

This system of water purification assures fisherman and downstream users of Silver Bow Creek water that is fresh, potable and free from the effects of any chemical or industrial contamination.

END



WATER is continually tested for pH at station house. pH electrodes are on small boat connected to chart meter above.

Northwest Convention Airs Nation's Gold Woes

Gold, Silver, and Money stole the spotlight from metallurgical advances, mining industrial engineering, mining methods, and geological exploration at Spokane, Washington, during the Northwest Mining Association's 66th annual convention early in December.

The record crowd at the Gold and Silver session, including many Canadians, heard producers, a financial analyst, and an economics professor discuss the flight of gold from the United States and what should be done about it.

While the United States government is taking daily steps to conserve gold the monetary economists, who clearly imply that gold is of use in the international monetary system, should be more concerned about that commodity, charged Franc R. Joubin, president, Bralorne Mines, Ltd., Vancouver, British Columbia. He added that if gold is useful to the monetary system, then why not pay greater attention to its supply? And he warned that the supply was now in jeopardy. The best source of available gold on the North American continent is Canada, Dr. Joubin declared, and then added that an increase in the price of gold could provide a strong economic foundation for the new state of Alaska.

Dr. Elgin Groseclose, Washington, D. C. financial consultant, pointed up the national concern about gold and charged, "The proximate cause of the gold drain is the failure to maintain a monetary system adequate to the world wide strains placed upon it." He pointed out that the "United States dollar is defined as gold, and world wide confidence in the dollar rests upon the assurance . . . that it will be maintained as a gold dollar." He then said that, "Despite the definition of the United States dollar in terms of gold, it has been increasingly a fiat money since the establishment of the Federal Reserve system." While the Federal Reserve Act authorized issuance of notes with a 40 percent gold backing the reserve has been cut until, "Today the gold backing is around 7.5 percent of banking and currency liabilities—less than at the time of the great collapse of 1932." Warning of the consequences resulting from gold policies, he urged that, "A great power like the United States cannot afford to trust its prestige and its vast responsibilities to the uncertain seas of fiat money."

"The United States silver certificates are the sole and remaining shreds in all the world of honest money," reported John Edgar, general manager of the mining division, Sunshine Mining Company, Spokane, Washington. "It is the only money anywhere that has survived two world cataclysms, has never been in default, and has remained redeemable at its tenure at all times," he added.

In the future the world will run out of silver unless the supply is brought into balance with demand. This unhappy monetary fact will happen soon because present day coinage requirements exceed domestic production, and so in the entire world the demand exceeds the new



GOLD AND SILVER reviewers and forecasters from left are: J. R. Huber, Department of Economics, University of Washington; Franc R. Joubin, president, Bralorne Mines, Ltd.; E. F. Cook, dean, School of Mines, University of Idaho; John Edgar, general manager, mining division, Sunshine Mining Company; and Dr. Elgin Groseclose, economic consultant, Washington, D. C.



INDUSTRIAL ENGINEER can save you money is unanimous report of T. G. Howe, Consolidated Mining and Smelting Company; Theodore Barry, management consultant, Los Angeles, California; John R. McWilliams, U. S. Bureau of Mines, Spokane, Washington; Stewart W. Hurlbut, Anaconda Company, Butte, Montana; and D. E. Redmon, U. S. Bureau of Mines, Denver, Colorado.



IMPORTANT NORTHWEST DEVELOPMENTS are outlined by William D. Nesbeitt, Allis-Chalmers Manufacturing Company; O. M. Bishop and W. T. Holmes, II, U. S. Bureau of Mines; Joseph Newton, head, Department of Mining and Metallurgy, University of Idaho; Edward D. Tierney, assistant vice president, Anaconda Company; and W. G. Hewitt, general manager, Pacific Division, Bunker Hill Company.

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supply, with the result that United States Treasury sales in 1962 will use up the free silver fund. The eventual answer to the supply of silver, Mr. Edgar said, "Appears obvious to everyone except the United States Treasury. It lies in increasing the world's silver production."

While the Gold and Silver session was covered with glamour, the technical sessions were well attended by supervisory and operating personnel.

Industrial engineering pays

Many operators found the Industrial Engineering session to be of particular interest as Theodore Barry, management consultant, Los Angeles, California, spoke on mining's new profit bonanza—industrial engineering. Mr. Barry said that mining had a fine record of accomplishments in improving processes and technology, but couldn't be proud of the progress toward a good degree of control of the labor efforts of the work force. Hence of real importance to the mining industry is the fact that "The biggest savings that industrial engineering controls can give come early." Also, "The savings in costs resulting from moving toward engineered control of costs is the most dramatic in the first few years."

The Anaconda Company has used Work Sampling as a Productivity Indicator as its Butte, Montana, operations with effective results to show management an accurate picture of how its manpower is being used, reported Stewart W. Hurlbut, senior research engineer. Anaconda recently made a work study of 2,000 men, taking 13,023 observations in 54 engineering observer shifts. The results have shown management the troubled areas, "The places where more detailed studies will point toward eliminating causes of delays. The net result can well be more production for the same number of shifts, or the same production for fewer shifts. Either way costs will be reduced," reported Mr. Hurlbut.

Lead-Zinc committee

The Emergency Lead-Zinc Committee needs the continuing help of every miner of these two metals in presenting a program to the new congress and new administration, reported Clark L. Wilson, Committee chairman. He said that the Committee felt that a new double barreled approach for legislative action was necessary for the various divisions within the industry.

Three natural divisions require separate degrees and measures of aid. Therefore legislation should provide

"Immediate effective help to the small and intermediate sized mining operation, and a tax plan that will provide long-term market stability to all," Mr. Wilson reported.

Mining and metallurgy

New methods and equipment for mining were outlined by E. R. Borchardt, consulting engineer, San Francisco, California. He reported on the drilling of large diameter mine shafts in Texas and New Mexico, the use of high energy metallized blasting agents in open pits, large diameter (8-inch) burn cut holes in drifting, new methods of simultaneous drilling and mucking in cut and fill stopes, and the possibilities for the new Blair loader (See page 29, November 1960 MINING WORLD).

St. Joseph Lead Company's new Viburnum lead-zinc-copper mine in southeast Missouri was termed a "new, profitable, and efficient lead belt." Three mines are being developed to supply one central flotation mill. Two mines are now producing ore and development of the third is progressing rapidly. Mill heads assay 3.0 percent lead and less than 1.0 percent each of zinc and copper in contrast to the 1.9 percent lead ore the company is now mining in the old lead belt. Elmer Jones, division manager, outlined the new belt at a special luncheon.

A warning was issued to the effect that an effort would be made in the next Congress to change the mining laws. G. Henry Ladendorf, Phoenix, Arizona attorney, said that a new 160 acre exploration claim bill will be filed. This would change time and value of assessment work, and would not require a mineral discovery to be made in order to stake a claim. The small prospector would be penalized because his assessment work cost would be doubled or quadrupled for this new type of claim.

Increased tonnages of low grade ore being milled at Anaconda, Montana, have meant that new car dumping, crushing, grinding, tailing thickener, and other equipment have been installed to raise copper or milling facilities of The Anaconda Company to 41,000 daily tons, reported E. D. Tierney, assistant vice president. Other improvements in both copper and zinc smelting and refining are being made, he added.

The technical sessions have grown in stature to play a large part in making the Northwest Convention one of the industry's most informative. END

MORE NEW EQUIPMENT... AND NEW LITERATURE

PULP DENSITY CONTROL of lead ore is detailed by an illustrated process application sheet which describes the operation of a Bailey Meter Company lead ore pulp density control system. Circle No. 39.

GYRATORY CRUSHERS designed and constructed for primary, secondary or tertiary stage crushing are detailed and described in an eight-page brochure issued by Sheepbridge Equipment Ltd. of England. Circle No. 40.

SIPHONSIZER made by Dorr-Oliver Inc. is a simplified hindered settling classifier for hydraulic cleaning and two product separation in the 20 325 mesh range. Circle No. 41.

DRILLING EQUIPMENT produced by Chicago Pneumatic is detailed in a new 16-page publication with ample descriptions and illustrations covering their complete line of products. Circle No. 42.

SYMONS CONE CRUSHER users will want a free copy of the 21-page handbook recently released by Nordberg Manufacturing Company. Titled "How to get the most from your Symons Cone Crusher" this valuable booklet will help in securing the best possible performance and maximum efficiency from these crushers. Circle No. 43.

GRINDING CONTROL based on the sound level of the grinding action is the new "electric ear" introduced by Hardinge Company. In a recent survey users report a 10 to 15 percent increased grinding mill capacity. Circle No. 44.

SCRAPERS that stand up under the toughest service conditions are a specialty with Alloy Steel & Metals Company who have models and sizes to suit every mining system. Circle No. 74.

CONTROL SYSTEM for conveyor belt feeding, blending, and proportioning is detailed in bulletin 57A by the Industrial Physics & Electronics Company. **CON-O-WEIGH** is a highly accurate

continuous belt scale for weighing free-flowing bulk materials. Circle No. 46.

DIESEL ENGINES for all types of mechanized equipment in a full range from 5 to 310 BHP in 1, 2, 3, 4, 6, 8 and 12 cylinders are manufactured by Deutz Diesel Energy Corporation. Circle No. 47.

FURNACES for roasting, calcining, drying and incinerating ores, sludges, chemicals, and organic materials are designed and built to your exact requirements by Pacific Foundry and Metallurgy Company. For information circle No. 48.

ALLOY STEEL design advantages and engineering properties of "T-1" alloy steel castings, plus welding and machining data, are covered in Bulletin No. 300-A, just issued by Alloy Steel and Metals Company. Circle No. 49.

TORQUE CONVERTER: Self-Changing Gears Ltd. of England has issued an excellent 12-page booklet titled "A Simple Explanation of the Torque Converter" which describes with diagrams and short descriptions the principles, functions and applications of torque converters. For a free copy circle No. 50.

FLWSHEET of a new heavy media process that provides efficient, low-cost wet-cyclone beneficiation of ore in the full size range from minus-2½-inch to plus-65 mesh is announced by Dorr-Oliver Inc. Circle No. 51.

BOOKLET describing test procedures for the evaluation of asbestos fibre has just been published by American Smelting and Refining Company. Circle No. 52.

NICKEL-ALLOY-bonded steel pipe and tubing are being used increasingly

to resist corrosion. This is described in a new brochure just published by the "Nickel-Over-Steel" Division of M. L. Sheldon & Company. Circle No. 53.

SAFETY MARK important objects and apparatus in your mine or plant with "Hi-Viz" industrial safety paint made by the E. D. Bullard Company that is four times brighter than regular safety colors and will last indefinitely indoors and up to two years outdoors. Circle No. 54.

BUCKET ELEVATORS for the handling of bulk materials are described in a new 22-page booklet just issued by Hewitt-Robins Inc. Engineering data and statistical tables are included in Bulletin 174. Circle No. 55.

RUBBER PIPE: General Rubber Corporation has just released their new Bulletin 866 covering their line of SoundZorber wire-reinforced flexible rubber pipe which reduces noise and vibration disturbance in pipe line installations. Circle No. 56.

CAR HANDLING: Richard Sutcliffe, Ltd., manufactures a full range of hydraulically operated tub and mincar handling equipment, developed to provide a safe and simple system of control for the heavier mincars now being used by the mining industry. Circle No. 57.

SCRAPER FILM: A 12-minute 16 mm motion picture film in sound and color, illustrating the operation of the 14-yard Euclid model TS-14 scraper, is available to interested groups by the Euclid Division of General Motors. For more information circle No. 58.

"SHAFT MUCKING with the 630" is the title of a new 8-page bulletin just released by The Eimco Corporation. Case

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histories, operational results and economies reported from many major companies are given. Circle No. 59.

EXPLOSIVES: Cyamon S blasting agent and Cyamon S primer, two new explosives developed for use in seismograph exploration are now available from the Explosives and Mining Chemicals Department of American Cyanamid. Circle No. 60.

CRUSHER: How the 16-50 Superior secondary crusher is able to handle higher tonnage at lower cost is told in a new bulletin released by Allis-Chalmers. Circle No. 61.

BROKEN castings of all sizes are repaired by Reynolds French and Company, specialists in repairing cracked or broken castings of all types and sizes. For a free copy of their booklet "Facts on Repairing Broken Castings," Circle No. 62.

"FRICTION MATERIAL for Industrial Equipment" is the title of a new 80-page catalog which lists braking and other friction materials for power shovels, hoists, take-off units, dozers, etc. This valuable reference work is given free to those who circle No. 63.

"DUST TOPICS" is the title of a 44-page publication that describes new equipment for dust surveys, air pollution analysis, radiation protection, and special sub-micron filtration apparatus. Gelman Instrument Company will send a free copy to those who circle No. 64.

WIRE ROPE CATALOG from the Sheffield Wire Rope Company, England, lists the breaking strengths of 153 wire ropes available to the mining industry, as well as other useful and interesting information on the storage and maintenance of steel wire ropes. Circle No. 78.

SCRAPER: A new, 22-page catalog describing the 430 horsepower V-Power B Tournapull 29-yard heaped capacity scraper is available from the LeTourneau-Westinghouse Company. Circle No. 65.

TRACTOR SHOVEL that is powerful, ruggedly built, and easy to operate is the 24-ton Allis-Chalmers HD-16G that automatically matches speed and power to load requirements and terrain conditions. Circle No. 66.

LABORATORY INSTRUMENTS: The 16-page LaPine Apparatus Review 12 announces many new laboratory instruments: spectrophotometers, pH meters, electrobalances, recorders, and related equipment that have recently been introduced by the company. Circle No. 67.

EQUIPMENT LINE offered by Baldwin-Lima-Hamilton Corporation is detailed in an illustrated 48-page booklet just issued by the company. Shovels, cranes, draglines, loaders, etc. are described. Circle No. 68.

DIESEL POWER: Operators of small trucks who wonder whether a conversion to Diesel power will pay off in higher profits will find the answer in a new booklet produced by Detroit Diesel Engines Division of General Motors. Circle No. 69.

INDUSTRIAL DIAMOND products are detailed in an attractive, comprehensive catalog just released by the Diamond Tool Research Company. Product photographs, diagrams, specifications, and pricing information are included. Circle No. 70.

SPECIAL FACILITIES available to the mining industry by the Hardinge Manufacturing Company are described

in Bulletin No. 101. A pictorial review of their major manufacturing departments is detailed. Circle No. 71.

"AUTOMATION AND YOU" is the title of a 15-page booklet that is a management summary of General Electric capabilities in industrial-automation systems. Circle No. 72.

BITS for down-the-hole drilling are now available up to nine inches in diameter from Atlas Copco. These Sandvik Coromant bits have all the famous Sandvik advantages of highest quality and longer life. Circle No. 73.

GRUSHERS by Sturtevant Mill Company assure long life at top loads for medium and small size plants. Many have operated for more than 25 years without a major repair. Circle No. 45.

PINCH VALVES are the subject of catalog No. 609 issued by Mines and Smelter Supply Company. These automated valve systems control the circuitry for any operating requirements. Circle No. 75.

CONCENTRATING TABLE: The Super-Duty Diagonal Deck table manufactured by the Deister Concentrator Company is the subject of their bulletin No. 118C. Low cost and high mineral concentrating efficiency are the features of this table. Circle No. 76.

ALIPHATIC AMINES—what they are and what they will do—are described in a new booklet prepared by Armour Industrial Chemical Company. These flotation agents are used for non-metallic separations detailed in a special Mineral Flotation Booklet also prepared by the company. Circle No. 77.

METAL WEAR is the subject of a new bulletin titled "Facts About Metal Wear For Maintenance Men" just issued by the Rankin Manufacturing Company. For a free copy circle No. 20.

DRY GRINDING and air classification test service offered by the Denver Equipment Company is described in their new bulletin No. T4-B25. Circle No. 91.

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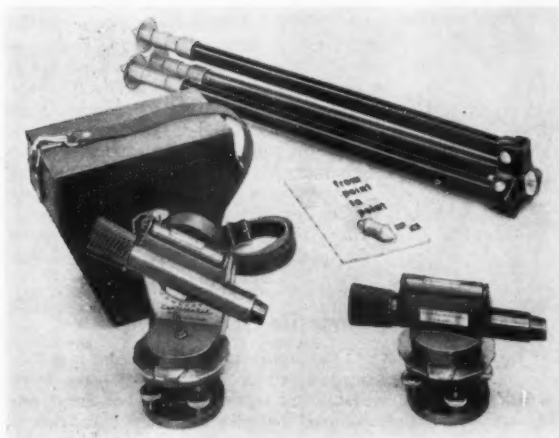
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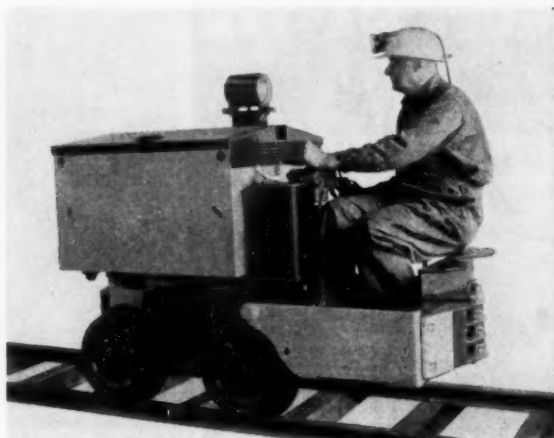
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Compact Surveying Instruments

A new line of David White instruments featuring compact size and light weight has been introduced to the mining industry. The new instruments are called the Continental No. 8040 Level-Transit and the Continental No. 8050 Level. A lightweight, extension leg tripod will be sold for use with the Continentals and an optional leather carrying case with shoulder strap will complete the package.

Both instruments are constructed of die cast high strength aluminum alloy with smooth enamel finish. Leveling plates are chrome plated and have a permanent built-in wick lubricating system. The circle rotates for zero settings and reads to degrees. Both instruments have 8X power telescopes with micrometer ring focusing. Circle No. 37.



Small Locomotive Fits Mine Cage

A new trammer-type locomotive has been introduced by the Greensburg Division of National Mine Service Company. Said to offer the most horsepower for its size and weight, the Greensburg Trammer folds to fit the standard mine cage and adjusts to any track gauge from 18 inches to 24 inches.

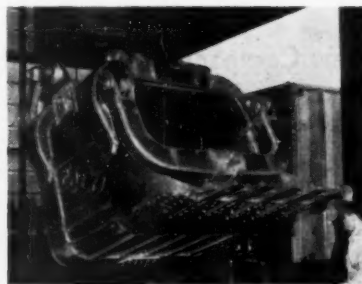
This locomotive is battery-operated requiring no trolley wire, and travels safely in narrow, haulage ways. It has a folding operator's compartment with removable separate end bumper, motorman's seat and end guard. Assembly or disassembly of the removable components for moving from one level to another on the mine cage can be handled easily by one man. Controls are accessible with compartment folded, so trammer can be driven on cage. Circle No. 38.



New Support Lagging

Availability of a new, economical and versatile support lagging for use as cribbing in mining and construction industries has been announced by the Commercial Shearing and Stamping Company.

Light, easy to handle, fireproof, and inexpensive, the new support lagging has a ribbed surface which permits interlocking when overlapped with the next lagging mat. This not only increases strength of the wall system and prevents dangerous gapping, but eliminates need for anchoring the mat, thereby decreasing installation time. Circle No. 28.



Big Aluminum Dipper

Aluminum plate, welding wire and rivets form the specially built excavating dipper, destined for Aluminum Company of America's Dominican Republic bauxite mining operations. Alcoa furnished technical assistance, welding equipment, and all the aluminum components to the Electric Steel Foundry Company, Danville, Illinois, where the lightweight bucket was built. Aluminum made possible an increase in the size and capacity of the dipper from 4½ yards (steel) to 5½ cubic yards, without a corresponding increase in weight. Circle No. 29.



Two Axle Dump Truck

The KW-Dart Truck Company of Kansas City, Missouri, has recently introduced a new end dump truck—the model 40SL. The 40 ton capacity vehicle is reported to be the largest capacity two axle dump truck ever placed into service.

The giant ore movers are 30 feet long, 13 feet high and 12 feet wide. They are powered by a V-12 Diesel engine coupled with a four-speed transmission-converter. Tires, front and rear, are 18.00 by 33.

Shown here is one of four model 40SL's recently delivered by KW-Dart. Circle No. 11.

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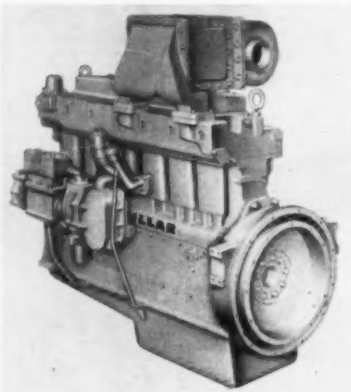
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New Diesel Truck Engine

The trucking industry gains another engine manufacturer with the introduction by the Caterpillar Tractor Company of its 1673 Diesel truck engine. This engine is a six cylinder turbocharged and



aftercooled power plant of 4.5 inch bore and 5.5 inch stroke of 220 hp at 2,200 rpm.

An estimated 85% to 90% of Diesel trucks on the road are in the horsepower class to use the 1673. These trucks have gross vehicle weights of 26,000 pounds or more, or gross combined weights of 50,000 to 75,000 pounds.

In the 1673, Caterpillar is offering the trucking industry a trouble-free fuel system, compact four-cycle design and mechanical excellence, all features important to economical operation and dependable performance. In the 1,900 to 1,200 rpm range, the 1673 uses only 0.398 pounds of fuel per brake horsepower hour, a very economical rate in truck engines. Circle No. 18.

New Compact Portable Drill Cores to 200 feet

The new Minuteman portable drill announced by Mobile Drilling, Inc. is a compact, multipurpose, rotary unit designed for subsurface exploration and production drilling in soils, rock and concrete. Precision engineered from lightweight, high-tensile alloys, the Minuteman is believed to be the only truly portable drill that features big rig rotary drive for greater drilling capacity and unusual versatility.

The Minuteman, when equipped for core drilling, drives "EW" core barrels to 200 feet. As a production boring rig it permits fast, economical erection of fences, guard rails, and similar installations. In addition, it handles standard soil sampling tools.

This new portable drill weighs only 150 pounds, yet features a six horsepower engine, eight-speed automatic transmission, diaphragm-type carburetor for drilling at any angle, 44-inch stroke with power or hand feed both in and out of the hole, wheel mounted base for easier handling and two point anchoring for maximum stabilization in soils, rock or

AM Explosives Producer

Chromalloy Corporation has announced entry into the ammonium nitrate explosives field with a new blasting agent called "Propex," to be delivered by special mixer trucks from distribution centers throughout the country.

Under terms of an agreement with Monsanto Chemical Company, Chromalloy will use Monsanto's Lion brand of ammonium nitrate fertilizer in the manufacture of Propex. The company will supply Propex either in 50 pound bags, or on a contract basis will deliver bulk amounts in special mixer trucks which carry the ammonium nitrate and oil in separate containers. This efficient method provides maximum safety since mixing of the sensitizing oil and ammonium nitrate oxidizing agent doesn't occur until the truck's discharge hose is in the blasting hole. Circle No. 6.

Versatile Grinding Mill

Development of the Trunducer grinding mill which incorporates three basic designs in a single unit has been announced by Allis-Chalmers. Utilizing a common component in conjunction with three different heads, the new mill can be easily converted to operate as an overflow rod or ball, a peripheral discharge or diaphragm mill.

The basic head, used on the overflow mill, is of flush covering surface construction with four discharge holes in a protruding discharge chamber. Spacers added to the shell's discharge end and an attached flat head with a stub shaft connected to the cable coupling, converts the unit to an end peripheral discharge mill. A plate added between the spacers and the shell transforms the machine to a diaphragm ball mill. Circle No. 26.



concrete. Although designed for one man portability, the Minuteman may be adapted for truck or trailer mounting as well. Circle No. 36.

NEWSMAKERS in world mining



V. N. BURNHART



F. J. HALLER



R. LETHBRIDGE



R. S. BATNI



R. W. TABER



F. W. WINK

Vincent N. Burnhart, former vice president and general manager of E. J. Longyear Co., Minneapolis, Minnesota, has been named president to succeed the late Donald M. Davidson.

Francis J. Haller, iron ore consulting engineer of Negaunee, Michigan, has been named a director and consultant of the Jubilee Iron Corp., Labrador, Canada. He has been associated with iron ore mining since 1930.

Albert W. Easton, former layout engineer at Kerr-Addison Mines Ltd., Virginiatown, Ontario, Canada, and Fred W. James, structural inspector on the Rocky Beach hydro-electric power dam in Washington, have been named to the engineering staff of Heath & Sherwood Chemical Grouing Ltd., Kirkland Lake, Ontario, Canada.

Morisuna Saigusa, chief geologist for the Mitsubishi Metal Mining Company, Ltd. has returned to his Tokyo, Japan headquarters after a mine inspection trip to South America. He visited copper and iron mines in Colombia, Peru, Bolivia, and Chile.

Taher Ziai, mining engineer, has been appointed minister of the Ministry of Industry and Mines of Iran. He succeeds Mr. Sharif Emami, who has been appointed prime minister of the country.

Roy Jure has been appointed manager of the exploration department of American Metal Climax, Inc., New York. Former assistant manager, he succeeds Jack A. James, who has resigned from the company to engage in private geological consulting work at 211 Bellair Road, Ridgewood, New Jersey.

Paul F. Yopes has been named chief of the branch of nonferrous metals of the U. S. Bureau of Mines division of minerals. Others appointed in recent staff changes within the branch are Raymond A. Heindl, assistant chief of the branch of nonferrous metals; Charles T. Baroch, chief of the branch of nonmetallic minerals and Donald O. Kennedy, assistant chief; Henry G. Iverson, chief of the branch of metallurgy research and James W. Pennington, assistant chief; and Thomas E. Howard, chief of the branch of mining research and Walter E. Lewis, assistant chief.

Horace Ham, chief mine engineer at Climax Molybdenum Company, Climax, Colorado, has been appointed new assistant chief engineer for the company. He is being succeeded by Bob Zdechlik.

Robert Lethbridge, director of technical services of the Rio Tinto Co. Ltd. of London, England, has been visiting open pit copper mines in the southwestern United States.

R. S. Batni, formerly an inspector of mines for the government of India, has been appointed professor of metal mining and surveying and head of the department at the Indian School of Mines and Applied Geology, Dhanbad, India.

Floyd H. Shellenberger has succeeded D. A. Underwood as mill superintendent of the Grandview mill of the American Zinc, Lead and Smelting Company at Metaline Falls, Washington. Mr. Shellenberger has served as mill metallurgist at Grandview for the past four and a half years.

Adrian C. Dorenfeld has joined the staff of the University of Minnesota School of Mines and Metallurgy as associate professor in mine and mill plant engineering.

Franklin W. Wyatt, mill superintendent of the Globe Mining Company, a unit of Union Carbide Corporation, has been appointed plant superintendent of the firm's uranium plant at Gas Hills, Wyoming. He succeeds K. W. Lentz.

Maurice F. Dufour, vice president of Freeport Sulphur Company, New York, has been named director of research and development for the company.

Austin Smith has been chosen assistant to the senior vice president of International Nickel Company of Canada, Ltd., Toronto, Ontario. He has been with International Nickel since 1936 when he joined the firm's Copper Cliff operations.

Lynn J. Richards has been named shift foreman of the Carlsbad, New Mexico, chemical plant of International Minerals & Chemical Corporation. Until his promotion, he was chemical plant operator.

Alvin Johnson, project engineer, has been appointed superintendent of field engineering for Oliver Iron Mining division, U. S. Steel Corporation. He will have temporary headquarters in Hibbing, Minnesota.

Bill E. Christian, former director of industrial relations at the Chino, New Mexico Mines Division of Kennecott Copper Corporation, has been appointed director of industrial and public relations at the White Pine Copper Company, White Pine, Michigan.

Robert W. Taber has been appointed assistant to the president of the Cleveland-Cliffs Iron Company of Cleveland, Ohio. He has been with the firm since 1939, and served in the mining department from 1950 to 1959.

F. W. Wink, sales manager of the Winkie Drill Division of Bucyrus-Erie Company, has resigned to form his own company, the Wink Corporation, with offices in South San Francisco, California. The firm is engaged in contract drilling, consulting and drill sales.

Frank Mattson, assistant general master mechanic of The Hanna Mining Company's Michigan district operations, has been named district master mechanic. He is replacing Carl Lundwall, who has retired. Others named in personnel shifts within the company are Lester Winton, maintenance foreman; Ward Richards, trammer foreman at the Hiawatha mine, and Manch Applin, maintenance foreman at the Hiawatha mine.

H. T. Heard, manager of the Cia. de Minas del Peru, Arequipa, Peru, has been appointed manager of mines of the International Mining Company, La Paz, Bolivia.

Frank H. Buchella, vice president of the Magma Copper Company and the San Manuel Copper Company, Arizona; Darrel Gardner, general manager of Magma Copper Company; and Carol P. Donohoe, president and general manager of Cananea Consolidated Copper Company, Cananea, Sonora, Mexico, have been awarded the University of Arizona's 75th Anniversary Medallion of Merit, presented to distinguished members of the mining industry.

Arthur W. Lankenau, superintendent of Union Carbide Nuclear Company's plant at Uravan, Colorado, has been appointed head of the company's experimental and development laboratory at Grand Junction. He is being succeeded in Uravan by O. J. Malacarne, former superintendent of the UCN plant at Slick Rock, Colorado.

Dr. I. Milton LeBaron, director of research, engineering and development for International Minerals and Chemical Corporation, Skokie, Illinois, has returned from the international physics symposium on high voltage electrostatic forces in Grenoble, France where he spoke on "Electrostatic Separation of Minerals."

Congratulations to These Men and



Man of American Mining in 1960 is Robert J. Linney, president of Reserve Mining Company, Silver Bay, Minnesota. He has spent his entire mining career in the iron ore industry and held important engineering and managerial positions with Republic Steel Corporation before he came to Reserve in 1950. At Reserve he was manager of operations and vice president of operations before promotion to president.

This award is made in tribute to his leadership in design, construction, and operation of taconite mining and milling facilities. Mr. Linney's drive and determination have been a major factor in commercial production of taconite pellets.

The mining industry pays tribute to him for the many contributions he has made to the continuous expansion of both production and technology in this new mining frontier.



The 1960 Engineer of Foreign Mining is George S. Scholey, general manager of Philex Mining Company, Baguio, Mountain Province, Philippine Islands. This award is a tribute to Mr. Scholey's long period of copper mine development in the Islands. He has played an important part, both pre- and post-World-War II in making underground and open pit mines from prospects.

As general manager of Philex he has played a key part in the exploration, development, and equipping for production of the Philex copper-gold ore body. He also supervised the engineering design and construction of the company's modern flotation mill, power plant, and mine camp.

The award is made in tribute to his special ability to evaluate a prospect and then to use his knowledge and skill to bring it into production at optimum rate for financial return.



For Technical Developments in the Mining Industry honors are being awarded to Robert Blair, chief mechanical engineer of the Anglo American Corporation of South Africa, Ltd., Johannesburg. The award is industry's recognition of the equipment developments he has made which have made high-speed shaft sinking practical and have made it possible to hoist from ultra deep shafts. With the development of the new low head Blair loader it now becomes practical to increase speed of mining by intense mechanization of thin dipping ore beds.

By the use of the Blair friction hoist it is now possible to sink a vertical shaft to any depth with almost no limit on the supported load. Mr. Blair's newer multi-rope, multi-layer drum hoist provides, in a double drum hoist, the advantages of a Koepe system heretofore unobtainable with drum hoists.

Here are industry highlights for the year

The soaring sixties got off to a short fuse fizzle mining-wise in 1960, despite the early hopes for increased use of many metals. It was the year of return to normalcy for many industries following the rush for production capacity to meet permanent defense requirements. For mining, capacity was more than adequate to replace depleted warehouse stocks which proved slow to rebuild in the face of no foreseeable shortages from existing mines.

The Golden Sixties, as I called them this time last year, lie ahead—and for mining they should be here in the mid-1960's when the experts say that copper demand will reach production capacity, and when the new uses for lead and zinc will provide markets for many additional hundreds of thousands of tons of metal. Ferro alloy and other metal use will grow accordingly.

The year 1960 was one of Communist gains in the Free World—Cuba, Bolivia, Guinea, Ghana—all countries important in mining. It was the year of continued economic war between the world's two camps. It was the year of increased Russian exports—planned exports of key metals and ores—exports planned to do the most harm to the United States' production-for-profit mining.

A year of planned exports and grandiose promises to win favor for Russia in strategic countries. More of the same as predicted here earlier.

In United States mining, 1960 will be remembered as the start of computer calculations of programmed mining. It was the year of the big beryllium search, the year of the London gold rush, the year of new copper mine developments in Arizona, and another year of major iron and lead (minor copper) discoveries in Missouri.

A year of taconite expansion, of metallized blasting, of larger pits and smaller underground, of beryllium tease, of uranium freeze, and metal ease.

Now for the future, and every miner believes more strongly in the future than in the today or he wouldn't light the fuses for the next drift round. It was Patrick Henry who said in 1775 that, "I know of no way of judging the future but by the past." With this future perspective plus words of wisdom and the fact that in the mining industry forecasts are made daily of tonnage, grade, markets, etc. I feel justified in picking the most important events of 1960 and forecasting the mining and metal future. The record's good, too, if you want to

Mines for Their 1960 Accomplishments

which have made them the winners of the annual awards
to outstanding leaders in the World's minerals industries



Open Pit Mine of 1960 is Kaiser Steel Corporation's Eagle Mountain iron ore mine at Eagle Mountain, California. Eagle Mountain has long been a development and proving ground for trucks, hard rock drilling equipment, bits, and blasting agents. The industry owes much to Eagle Mountain and the equipment manufacturers for these developments. As an operating mine Eagle Mountain has achieved outstanding production rates per man shift, low stripping and mining costs, and an excellent safety record. Robert G. Heers is manager of mining and raw materials, and Martin J. Hughes is mine manager.



Small Mining Company of 1960 honors go to the U. S. Beryllium Corporation for its pioneering development of the Badger Flats, Colorado beryllium district: the Boomer, Blue Jay, and Redskin mines. By proving for the first time the mineability of bertrandite (a rare beryllium silicate), and for being the largest domestic producer of beryllium ore. The company's pioneering work in discovery, mining, marketing, and refining of beryllium ores have opened new geodesic is Don H. Peaker of Pueblo, Colorado, a trained geological engineer who sees a bright beryllium future.

and a future forecast

by George O. Argall, Jr. Editor

review the past—both mining and forecasts.

It's often harder to find out who made the discoveries of the year in the year that they were made than for the finder to make the actual discovery. The exploration slow down of last year resulted in fewer discoveries.

However, in the United States important discoveries of lead continued to be made by copper and other miners in Missouri. No one knows just how big the new Missouri Lead Belt, first reported in this Review three years ago, will finally prove to be.

Beryllium discoveries made the news in the United States during the year with most publicity coming from Washington, D. C. about "widespread occurrence of beryllium mineralization reported in Idaho," and a "second discovery of widespread beryllium mineralization in the Yellow Jacket Mountains." Both are in the south central part of the state, both are in granitic rocks, and both contain beryl and aquamarine



Underground Mine of 1960 has been selected as being the Viburnum mine of St. Joseph Lead Company in Missouri's new lead belt. The selection is based on the facts that this is the first mine to develop this important new and high grade lead district, that the mine is completely mechanized for high production per man shift, and that several outstanding mining techniques have been used to develop it and bring it into production.

St. Joseph's designation is simply No. 27 mine where the mine crew is 50 men for 2,000 daily tons, machine men break 150 tons per man shift, and 325 tons per shovel shift.

crystals. The deposits are within several tens of miles of each other, but in different mountain ranges.

The alumina bypass was the **Metallurgical Development of the**

Year. This is the conversion of bauxite ore directly to aluminum metal bypassing the costly intermediary step from ore to alumina. Aluminum Limited perfected and patented

a method for catalytic or subhalide distillation wherein aluminum ore is treated to yield a gaseous subhalide of aluminum at a high temperature from which relatively pure metal is

Beryllium in United States and Philippine Copper Make Year's

The **United States Discovery of the Year** was the new beryllium mineral in the Topaz Mountains of western Utah. This discovery points the way for further prospecting in unusual geological environments for beryllium minerals. The pink variety of beryl has been known in the Topaz Mountain rhyolite for more than 50 years and the occurrence of such, though rare, is rather unusual to find in flow rocks. Norman C. Williams, vice president of Beryllium Resources, Inc. has long been interested

in the area and has directed field work there since 1956. It appears possible that the Atomic Energy Commission secretly discovered beryllium in some rocks of the area in 1959. Early in 1960 Beryllium Resources, with the aid of a beryllometer, detected beryllium in the field. About the same time prospectors found beryllium mineralization and submitted samples to both Beryllium Resources and Vitro Corporation of America.

The importance of this discovery

was confirmed near the end when the president of Brush Beryllium Company, a Beryllium Resources stockholder, reported that there might be from 2,000,000 to 10,000,000 pounds of contained beryllium metal in area.

Beryllium figured too in the **Mining Option of the Year** when the Anaconda Company optioned 103 mining claims of Mt. Wheeler Mines, Inc. at Mount Washington, Nevada. Anaconda plans extensive underground development program in zones which assay about 1.0 per-

Set Many New Mining Records for Shaft Sinking, Shovel Loading,

Not only do the world's citizens run and swim faster each year, as the 1960 Olympics proved in the sporting world, but the mining world's engineers sink faster and drift faster. And the same competitive spirit exists between the Free and the Curtained worlds as evidenced by the speech of W. S. Findlay, president of the South African Institute of Mining and Metallurgy, on August 24th when he said, "We have even beaten the Russians at shaft sinking, which, in the Sputnik age, is no mean achievement." This proved an understatement by year's end, after the Hartebeestfontein Gold Mining Company, Ltd. sank its 26-foot rock section circular No. 4 shaft 1,106 feet during October. The Russian record is reported at 868 feet of 18-foot diameter

shaft in one month. The old record was 1,020 feet by President Steyn Gold Mining Company, Limited, in January 1960 which beat that company's 1,001 feet sunk in November 1959. These records were set in different shafts.

A new world record was set for open pit shovel loading when C. J. Robinson loaded 158 railroad cars in a single shift at Kennecott Copper Corporation's Utah pit. This is 13,500 tons of ore for a remarkably high shovel factor. It took only 2.6 minutes to spot, load, and respot each car. In Canada at the Ruth Lake mine of Iron Ore Company of Canada, six shovel shifts (two shovels) loaded 320 railroad cars with 28,000 tons of iron ore in 24 hours.

A rotary drilling record for Ken-

necott's Chino pit was set by J. L. McLehane and George L. Oliver—540 feet of blast hole in one shift.

Rhokana Corporation Ltd.'s copper smelter in Northern Rhodesia produced 28,214 tons of blister copper from one mine in April, which must be close to a smelting record. Also in Northern Rhodesia, Nchanga Consolidated Copper Mines Limited set several records. For the first time more than 1,000,000 cubic yards of ore and waste were mined in one month from the Nchanga and Chingola open pits. In the Nchanga pit the bucket wheel-conveyor system dug and transported waste to dump at the rate of 2,271 tons per digging hour. Based on cubic feet of rock broken in contrast to feet driven a world record was set in Nchanga's

Important Anniversaries—Two Great Lead-Zinc Districts, Gold,

The end of another year always means that birthdays, anniversaries, and commemorative dedications were held by the world-wide mining industry during the year.

For it was in September 1885 that prospector Noah S. Kellogg and his balky burro discovered the original ore outcrop that has since proved to be one of the world's largest lead zinc mines—Bunker Hill in northern Idaho. The Bunker Hill Company normally is the second largest lead producer in the United States to this day.

In the far off desert of New South Wales, Australia, mining began the same year on another the now famous Broken Hill lode—with the formation of the Broken Hill Proprietary Company.

Also celebrating its diamond ju-

bilee of engineering and construction service to the mining industry was the Stearns-Roger Manufacturing Company of Denver, Colorado.

It is just 100 years ago that Fraser and Chalmers Limited started making mining and metallurgical machinery in England. It has since been absorbed into the General Electric Company of England which has carried on the mining tradition.

The U. S. Bureau of Mines was 50 years old on July 1st and the industry paid just tribute to the mine safety work and the first aid training of the Bureau as well as to its statistical, mineral surveys, and other services.

One of the world's greatest gold mines—Hollinger Consolidated Gold Mines Limited—celebrated its Golden Jubilee with the proud record of \$500,000,000 worth of gold and sil-

ver produced. This Canadian mine has more than 128 miles of crosscuts and 243 miles of drifts, for a total of more than 371 miles of main openings. Shafts, winzes, and raises total several tens of miles. Its diamond drills have yielded 1,189 miles of core. The 59,000,000 tons of ore mined were replaced with 30,124,199 tons of fill.

Forty years ago the first electric-powered loading equipment—an 8 yard Marion dragline—was used on the Mesabi Iron Range by the M. A. Hanna Company at its Wabigon mine. Hanna continues to pioneer mining and beneficiation practices on the range.

The great Carlsbad, New Mexico potash district was discovered accidentally only 35 years ago when oil well drillers Snowden-McSweeney

recovered in a condenser. Simultaneously the French aluminum producers, Pechiney and Ugine, developed a similar process for which details are not publicly available.

Discovery News

cent BeO. Many of you will recall that the Mt. Wheeler beryllium recognition was the **Geologist's Discovery of the Year 1959** in a similar article to this at the end of 1959.

Foreign Discoveries of importance were the Sierra Madre copper deposits in east central Luzon, Philippine Islands; the Prospectors Airways-Kerr Addison copper discovery in northwestern Quebec; and the prospector's discovery of gold in the Patricia district, Northwestern Ontario, for Kenlew Mines.

and Drifting

14 by 14 foot No. 2120 haulage way in July when 240,000 cubic feet of rock were removed in driving 1,248 feet in 26 days.

A new, big tunnel record, 135.5 feet in one day, was made by the 30 foot diameter mechanical mole at the Oahe Dam, South Dakota. A 1,152 foot long tunnel was bored in only 14 days.

New daily and monthly production records were set by International Minerals and Potash Company at Carlsbad, New Mexico; 15,019 and 407,759 tons respectively. International mined its 50,000,000th ton of ore in July.

Kennecott Copper's Nevada Mines Division set a new daily and monthly crushing record in August when 27,204 and 709,286 tons were crushed.

Diamonds, Potash

found more potash than oil. This was the first of New Mexico's two great mining districts to be found looking for oil. The second was just five years ago when cuttings from a dry well at Ambrosia Lake were found by Louis Lothmann to contain uranium. First ore was mined in March 1956 from the nearby, just sunk, Dysart shaft of Rio de Oro Uranium Mines, Inc.

Two great African diamond mines marked their 30th and 20th anniversaries during the year. In January 1930 diamonds were found on the Gbobra River in Sierra Leone. From this discovery the great fields of Tongo and Yengema have been developed.

The last great diamond mine discovered was only 20 years ago by Dr. John T. Williamson at Mwadui, Tanganyika.

TOMORROW'S MINING PREVIEW

What the miner needs

Holes, both larger at smaller cost and smaller at lower cost, are needed by the mining industry. This is not a paradox either, as the trend to larger and larger burn cut holes is here to stay. The bigger the burn hole the better of course, but the added cost to increase hole diameter has about reached the point of no return for most mines. Drills, bits, and rods are now available to drill an 8-inch burn cut hole 12 feet deep in hard silicified metamorphic rock in 30 minutes. To reduce small holes further now means more money too because of high rod breakage and low powder loading factors. Better drill steel and higher density explosives are needed for further hole size reduction.

Some way must be found to cut only the annular ring for the truly big holes the way a diamond drill does. The central core must simultaneously be sheared off and automatically ejected in chunks from the hole to lower cost of these big holes.

Watch these prospects and trends

Africa will continue to make mining news in the new year. Watch for Newmont Mining Corporation and associates to develop a major open pit copper mine and build a many thousand ton per day flotation mill.

A very new molybdenite prospect in Nigeria may be developed by a United States company. The world's most modern lead smelter will be built in Africa too.

Arizona copper, too, will make news. Watch for expansion at one of the largest flotation mills backed by important ore reserves. More copper per ton is the goal of one mill where acid leaching of oxides and precipitation to sulphides before flotation is under test. It's too early to know if the entire mill will be converted to this flowsheet. You can be assured that a copper leaching plant will be built for testing and flowsheet development on copper oxides and silicates from a now-developing mine.

You can expect a new open pit nickel mine to be brought into production by International Nickel Company of Canada, Ltd. near Copper Cliff, Ontario.

Don't be surprised if Yerington assumes a more important role in the mining world. Now famed for copper, from Anaconda's Weed Height's pit, the new look at Yerington will be iron. It's big iron in point of reserves, it's low in point of grade, and it's deep in point of location. Holes have been drilled to depths of 2,000 feet. The top of the deposit is at least 400 feet below surface, in places. While the United States Steel Corporation, Columbia-Geneva Division, hasn't released full data on this deposit it probably will rank high with any geophysical discovery as the **Geophysical Discovery of 1960** because drilling of an airborne anomaly discovered iron.

You can look to Wyoming for the scene of next year's shaft sinking rush. If current proposals are carried out there will be at least six and perhaps eight new shafts near Green River to further develop Wyoming's Trona Trend. Three major chemical companies have developed important ore reserves here. Several other mining companies have enough reserves to warrant mine development too.

While on the subject of shafts, don't discount the possibility of a new method for sinking shafts through quicksand and heavy water bearing sediments. Also look for a real breakthrough in shaft sinking by rotary drilling. See this issue, "How Rotary Drilling Speeds Shaft Sinking," for a report on success with 44-inch diameter shafts. The next step out will be to production size.

Now for equipment: New methods to empty trucks, not dump them, are under study. Push the material out rather than raise the body to dump the load. Why not speed pit loading by picking up truck unit loads at one time? The electric wheel application has just scratched the surface in its mining applications. The electric wheel drive trucks will get faster pulling under the shovel and on the waste dump.

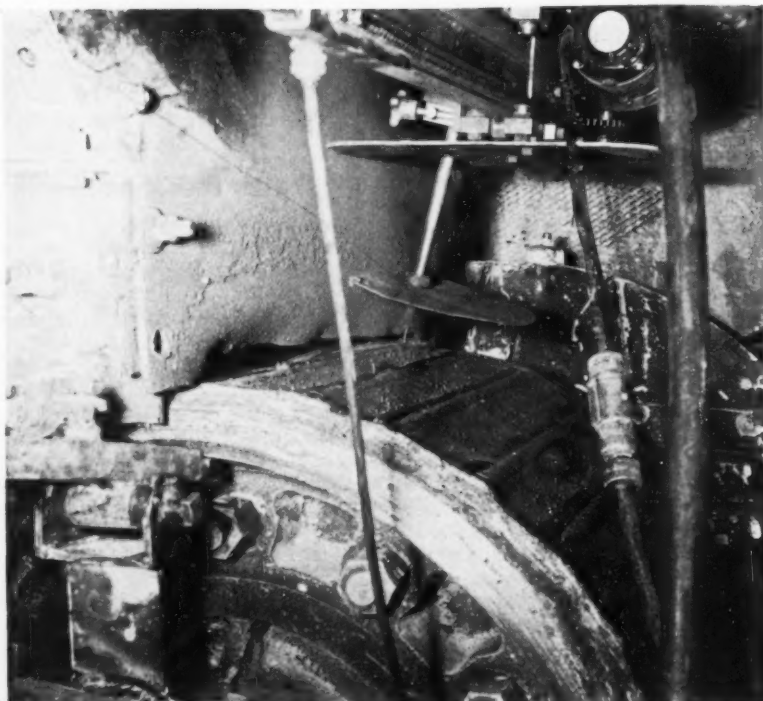
New progress is being made on small rotary percussion drills. New equipment will speed cut and fill stoping with simultaneous drilling over ore mucking or waste filling.

In mineral processing new crushers will lick sticky ore problems, several new moisture removing machines will cut water content of various products, and new reagents will increase metals recovery.

END

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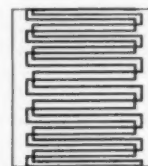
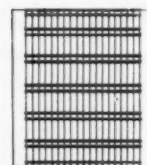
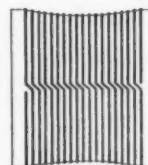
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WHAT'S GOING ON in mining

Kennecott Will Install Big Skip Hoist System at Chino

The largest open-pit skip hoist system of its kind ever to be built is being installed by Kennecott Copper Corporation at its copper mine near Santa Rita, New Mexico. The Chino Mines Division of Kennecott has awarded a contract for some \$2,350,000 to the National Iron Company of Duluth, Minnesota, for construction of the hoist.

The new installation will make available for economical mining several million tons of ore at the bottom of the pit, permitting use of trucks which can operate in close quarters. If the present train haulage system at the mine were extended in depth it would require the stripping of much waste to make room needed for train operation.

The skip system, which will hoist more than 1,000 tons of material an hour, will consist of two 40-ton skips that work in counterbalance rolling up and down a 1,400-foot, 12-foot wide track at an incline of 30°. A 40-ton bin at the bottom will be loaded by trucks which carry 40-ton loads. When a skip is filled, it will be hoisted to one of two unloading stations at the top, while an empty skip rolls down the track for loading. One station is for ore which will go to the mill at Hurley, while the other is for waste that is taken to nearby dumps. Trains are used for this phase of the operation.

Steel cables, 2¼ inches in diameter will pull the skips up the incline, and power

will be supplied by four electric motors with a total of 2,000 horsepower. Much of the operation is automatic.

The Chino mine will resemble a "pit within a pit" when the hoist system is in use. At present the pit slopes gently toward the bottom. A sharper slope will be possible in the areas mined by trucks and the skip, creating the effect that a smaller open pit has been started at the bottom.

Anaconda Options Beryllium Claims of Mt. Wheeler Mines

The Anaconda Company has acquired an option on some 103 beryllium mining claims covering about 2,000 acres in the Mount Washington district 40 miles southwest of Ely, Nevada. The property is owned by Mt. Wheeler Mines, Inc., and was formerly under option to Beryllium Resources, Inc.

According to a statement from the Anaconda and Mt. Wheeler firms, Anaconda will undertake an extensive underground development program to determine the extent of the indicated beryllium-bearing ore zones. The option will extend over a two-year period.

Anaconda is also interested in the Jeppson claim group north of the Mt. Wheeler property in the same district of White Pine County. These claims, owned by the Jeppson family of Ely are adjacent to the Mt. Wheeler property and cover some 300 acres.

A crew of Anaconda geologists last summer sampled the beryllium ore in areas formerly explored by other firms for tungsten and lead-zinc ores on the Mt. Wheeler property.

Although no reserve estimates were given, they have been listed as substantial. The deposit is reported to be easily mineable and ore is amenable to flotation. Principal minerals in the deposit are phenacite and bertrandite—beryllium silicates.

Arizona

A new steel-making process that uses no coke or scrap metal will be used at the steel mill under construction by Arkata Steel Company near Coolidge, Arizona. The process, developed by Julius D. Madaras, a vice president of Arkata, is designed to make use of low grade iron ore from an open-pit mine 35 miles south of Florence and west of Oracle Junction, Arizona. Construction on the multi-million dollar plant with a 75-ton-per-day capacity is scheduled for completion this spring. According to Madaras, this type of plant costs about one-fourth as much as a blast furnace and coke oven of the same capacity. Reducing gas used in the process can be obtained economically from natural gas, oil, low-grade coal, or lignite.

The copper-leach project at the DeSoto mine is in production and making



Arizona Dry Gold Placing Machine Uses Butane Fired Dryer on Fines

Desert Gold Mining Company is now using a 15-cubic-yard-per-hour portable dry land gold dredge, manufactured by Hirsch Brothers Machinery Company of El Paso, Texas, on the San Domingo placers near Wickenburg, Arizona. The dredge pictured above at left is considered an exploration and sampling model which is used to sample the placer by excavating trenches to bedrock on 200-foot centers. Hirsch Brothers is now building a 150-cubic-yard-per-hour production machine for Desert Gold Mining Company, and has orders for two other similar machines as well as for two 30-yard-per-hour units. Since starting operation in mid-October 1960 the operating cost of the dredge, including overhead, wages for two operators, and equipment amortization, has been \$8.00 per hour.

In picture at left Diesel electric set in truck at far left furnishes power for scraper to excavate gravel and to operate plant. The picture at right shows gold recovery section with cloth covered table slanting to left, over box which houses

blower forcing air through material on table. Drier discharge is at top right. Large pipe at bottom carries off dust. Recovery depends on the value of the bold-bearing gravel which is being sampled. One pocket was rich—gold recovery being \$6.00 per cubic yard. Key to successful recovery is the fast drying method used on the fines, minus-1/10-inch, removed from gravel by a grizzly and double deck vibrating screen. Fines are conveyed under a battery of butane-fired infra red heating heads producing a temperature of 1,600° F. which raises surface temperature of fines to 150° F. in 10 seconds to bring the moisture to the surface. Air is blown across the surface in a special aeration chamber to reduce moisture content of fines by evaporation to between 1.0 and 4.0 percent. Gold is separated from rock by gravity and static electricity on inclined table. Basic concept and design of the machine was by Kelsey L. Boltz and Donald W. Wright who have been in charge of sampling.

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Exploration and evaluation Dredge near Wickenburg, Arizona, in \$1.20 per cubic yard gravel.

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*Checking electrical system on location.
Left to right: Fredric Brucker, Hirsch
Brothers Machinery Co., Kelsey L. Boltz,
Donald W. Wright, inventors, Herbert J.
Miller, Desert Gold Mining Co.*

WHAT'S GOING ON . . . SOUTHWEST

shipments of cement copper. The operation is conducted by Richard E. Chilson of the **Chilson Mining Company**, of Tucson, Arizona. It is a combination of leach-in-place and heap-leach methods. The plant consists of a compartmented precipitation box of concrete construction, a high pressure pump driven by a 60-hp. motor, and a mixing box and sump. These are located on the dump a short distance from the main adit portal. Other equipment consists of a Diesel-generator set, a bulldozer, and miscellaneous pipe and tools. Barren solution flowing from the tail of the box is brought up to proper acid strength by addition of sulphuric acid and is then pumped through 2-inch plastic pipe up the steep heel surface to discharge into the openings at the top of the mine and trickle down through the workings. The maximum pumping head is 600 feet. The pregnant solution is collected in settling ponds on the lower adit level and flows out the adit into the head of the precipitation box. The precipitant is iron in the form of cans, scrap iron and baling wire. Water is obtained by pumping from the shaft below the main adit level. The DeSoto, located in the Peck mining district of Yavapai County, has a production record dating back to about 1890. At one time it was the principal ore supplier for the smelter at Humboldt. The value of its past production of copper, gold and silver is estimated at \$3,250,000.

The **Banner** pozzolan project, north of Flagstaff, Arizona, has been taken over by **Standard Pozzolan Company** of Hereford, Texas. Darrell W. Sumner, Flagstaff, is superintendent. Output from the plant is averaging about 300 tons per day, and plans call for 400 tons per day very soon. The pozzolan is trucked to the Glen Canyon Dam to be used with cement to give the concrete mix additional strength. The Bureau of Reclamation specifications are quite exacting—requiring extremely selective mining and close control of size of product. A crew of 20 men is employed.

The **Golden Sands Project** is employing a crew of 10 to 12 men at its operations about six miles east of Morristown, Arizona. The company has been actively engaged in exploration and plant construction at this placer property for the past year. Project personnel include Walter A. Martin, of Scottsdale, Arizona, and A. J. Henry, superintendent, Wickenburg, Arizona.

California

The asbestos project of **Jefferson Mining Corporation** near Copperopolis in Calaveras County, California, is scheduled to be completed by December of this year. The project includes building a \$5,000,000 asbestos mill and other facilities to process ore from a deposit of chrysotile asbestos that has probable reserves of some 5,000,000 tons. **Jefferson Mining** is a subsidiary of **Jefferson Lake Sulphur Company** of New Orleans, Louisiana.

The \$11,000,000 expansion program of **American Potash & Chemical Corporation** at Trona, California, will add

approximately 35 percent to the firm's capacity for producing boron material, and 25 percent to that for potash, as well as increasing output of other company products.

Construction of an additional sodium sulfate production unit at Westend, California, has been started by **West End Chemical Company**, a division of **Stauffer Chemical Company**. The new unit, scheduled to go on stream early this summer, will raise the company's sodium sulfate output to 200,000 tons a year. Operations to recover soda ash and borax from the brine deposits began at Searles Lake in 1927, and in 1955 West End built production facilities. As second unit was added in 1957.

Nevada

A new gold mine, the **Blue Star**, is under development 25 miles north of Carlin, Nevada, and the owners are building a 300-ton-per-day cyanide mill for operation this fall. The **Blue Star**, or No. 8, mine has been a steady producer of turquoise the last 25 years with output valued at about \$400,000. The gold area of the mine was unsuspected until June, 1959. Gold mineralization occurs in an overthrust plate of altered shale on top of lime. Gold values are now in evidence in an area 2,500 feet wide, showing in drill holes which penetrate to a depth more than 100 feet from the surface. Costs for open pit mining are estimated at 75 cents per ton, and cyanide leaching costs about the same figure. Initial ore supplies will come from a thoroughly sampled area. The **Blue Star** project is a joint venture of **Combined Productions Associates** and **The Sierra Nevada Company**, both of Salt Lake City, and the **MM and S Exploration Company** of Nevada. The latter firm, which is operating the mine, has recently been associated with the **Bootstrap** gold mine near Elko. Robert Morris is general manager of the project.

Production at a fertilizer processing plant in Pioche, Nevada, is scheduled to begin in February. The plant, which will process iron pyrite from mill tailing of **Combined Metals Reduction Company**, is being built by **R. J. Dalton and Sons, Inc.** The fertilizer product is an agricultural mineral used on lawns, gardens, and orchards and as a mix with other fertilizers.

The redevelopment program of **White Caps Gold Mining Company**, began over four years ago at its mine near Manhattan, Nevada, has been virtually completed. Cost of dewatering, retrimbering and general clean-up was about \$330,000. Final phase of the project was preparation for a two-stage drilling program that will drill for an extension of an ore body that has produced over \$5,000,000 in gold during earlier operations.

New Mexico

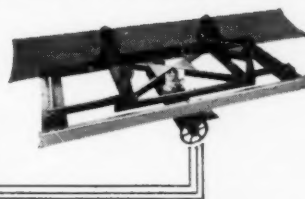
A series of mine safety courses for employees of the Grants, New Mexico, area uranium firms is being held January 9 through February 10 at the Oil, Chemical and Atomic Workers' Union Hall in Grants. The series is being presented through the joint efforts of the State Inspector of Mines, the U. S. Bureau of Mines and the various area unions.

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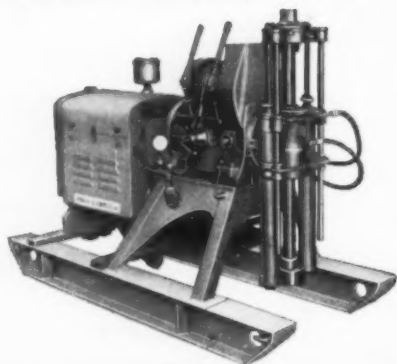
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WHAT'S GOING ON . . . SOUTHWEST

Courses will be divided into two classes a day, with employees of **Kermac Nuclear Fuels Corporation** as the first group to attend. Each mine's employees will be given instructions one day a week. Classes last two hours and each mine will take classes for five weeks. Because of the interest in the project, efforts are being made to secure another instructor to teach additional groups. The series has the approval of the Uranium Operators Safety Council which sponsored a recent series of U. S. Bureau of Mines classes for supervisory personnel, and earlier had recommended increased safety instruction because of the accident record for the industry in the last five years. Safety recommendations made by the Council included: All supervisors should carry a small bar for sounding and scaling; training underground workmen in problems of rock failure and pressures; tightening of disciplinary measures for poor "bar down" procedures; use of a special "bar down" man in some operations; caution in development and stope planning in regard to failure of small pillars; safe access to tail blocks; adequate face and rib protection while drilling; proper support to corners and ribs; advance planning in regard to failure along fractures when ground is subject to pressure; improved recognition of potential hazards by visits to other mines; increased stress on studies of rock mechanics made by the Bureau of Mines; registered safety representatives for each unit; better safety indoctrination for new employees; compulsory first aid training; familiarization program for new workers; stringent check of new employees' previous safety records; adoption of basic regulations by Council members; and consideration of starting a safety incentive program.

A merger of **Pacific Uranium Mines Company** into **Kerr-McGee Oil Industries, Inc.**, under consideration would give Kerr-McGee ownership of the former's Ambrosia Lake, New Mexico, uranium ore reserves. Production from this property is now committed to the Ambrosia Lake, New Mexico, mill of **Kermac Nuclear Fuels Corporation**, which was formed in 1956 by Kerr-McGee, Pacific Uranium and **Anderson Development Corporation**. Kermac's rate of uranium mining and milling is over 110,000 tons per month and the mill is operating at above designed capacity. Kerr-McGee, which has its headquarters in Oklahoma City, recently became associated with three other oil companies to form **Petrotomics Company**, which has large uranium ore reserves in Wyoming. Kerr-McGee is also the country's third largest producer of vanadium, which is a by-product of its Shiprock, New Mexico, mill where a high purity vanadium circuit was installed early in 1960.

Industrial hygiene in the uranium industry was the subject of a one-week course sponsored in December by **The Anaconda Company** for industry representatives in the Grants, New Mexico, area. Invitations were issued to all uranium mine and mill operators in the area to attend the five-day session at the mill-site in the Anaconda community. Instructors included representatives of public health, sanitation, and industrial hygiene groups from New Mexico and Utah.

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Alaska

A redraft of proposed mining regulations now in preparation by the **Division of Mines and Minerals of the Alaska Department of Natural Resources** will contain revisions proposed during a series of public hearings held in November in five Alaskan cities. Before the hearings the Division received many emphatic written statements on the subject of mining legislation, and the hearings themselves brought out much testimony both for and against any departures from the present laws. Conferences held after the hearings indicate the redraft will probably contain the following proposed provisions: Prospecting sites—maximum size, 160 acres, maximum number of 6 in any recording district, one-year limit with extensions allowed on showing of need, "prospecting" work at \$5.00 per acre per year for two years starting with date the site is staked, and \$10.00 per acre per year for corners to be posted and lines to be flagged, location certificate to be posted on site and to carefully describe situation of site. Mining claims—maximum size 40 acres, no extralateral rights, no distinction between lode and placer, 4-post staking, brushed-out lines, corner posts and location notice to be maintained in good conditions, lines N-S-E-W as near as practical, no limit to number of claims, \$100.00 worth of assessment work per claim per year. Those who wish copies of the redraft may obtain them from the Division of Mines and Minerals, Box 1391, Juneau, or the **Division of Lands** at 340 Sixth Avenue, Anchorage.

Idaho

The newly formed independent **Northwest Metal Workers Union** was chosen to represent striking employees of **Bunker Hill Company** at a special election held December 10 in Kellogg, Idaho. The election, administered by the **National Labor Relations Board** as the strike went into its eighth month, gave the local union 672 votes, while the **International Union of Mine, Mill and Smelter workers** received 621. Eight votes were cast against any union representation. The action decertified the Mine-Mill group as a bargaining agent and left the company free to negotiate with the new group. Bunker Hill officials immediately called over 200 maintenance work employees back to work to prepare the mines, mill and smelters for start of operations. Both company officials and representatives of the Northwest Metal Workers expressed confidence that satisfactory contract details can be negotiated. About 1,875 Bunker Hill employees struck the lead-zinc firm last May 5 after a year of unsuccessful negotiations for a new contract. The new contract will probably call for a wage boost of about 18 cents an hour, plus fringe benefits.

A second occurrence of widespread beryllium mineralization has been noted in central Idaho by engineers from the Spokane office of the **U. S. Bureau of Mines and the Idaho Bureau of Mines and Geology**. It is in the Yellow Jacket mountains, 80 miles north of the initial Sawtooth Range discovery made last summer. Blue (aquamarine) and green beryl were found in granite rocks over an area of a few square miles but it is

not known whether commercial deposits exist. A Spokane team with a mobile spectroscopic laboratory traveled 30,000 miles during the past field season in a search for beryllium, cesium, and other rare metals needed by government space-age researchers. Low-grade deposits of columbium, tantalum, lithium, and uranium also were noted on the fringes of the Idaho Batholith, a granite intrusion covering a good portion of Idaho.

Idaho Mining & Milling, Inc., at last report was well along with assembly of a gold dredge at its placer ground in the Florence Basin, Idaho County, Idaho. The dredge was dismantled at Warren, Idaho, and moved across the mountains by trucks. Pontoons were scaled of rust, welded where necessary, and painted before assembly. A crane was obtained to lift steel framework into place on the pontoons. Delivery of necessary machine parts from Lewiston and Spokane was speeded by installation of an airstrip and two-way radio telephone. Phillip W. Jungert of Lewiston is company president.

Montana

The **M & H Mining Company** is now operating the **Crystal** mine northwest of Basin, Montana, which contains a complex lead, copper, zinc, gold, and silver ore. Considerable production has come from the mine in past operations. Working through an adit, ore is now being produced from the lower of two levels in the mine. R. C. Hartmann of Boulder, Montana, is general manager. The **M & H** firm also controls the **Mt. Washington** group of claims near Jefferson City and

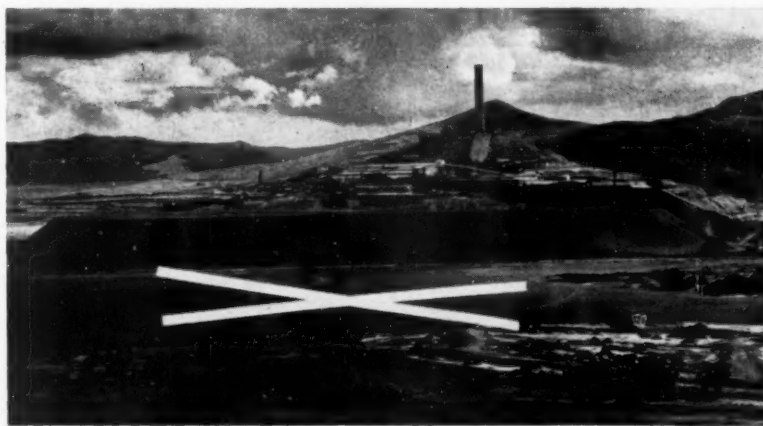
last year completed plane-table maps for the property. A new adit is planned for next spring.

Five rich silver veins from 8 to 24 inches wide have been found under 14 feet of limestone capping at the **New Departure** mine near Bannack, Beaverhead County, Montana. The high-grade is expected to raise mill heads above 30 ounces of silver per ton. Development of the ore zone is proceeding. A new 7-mile road has been built to the firm's mill at Bannack and installation of a fine ore crusher is planned to bring production up to mill capacity of 150 tons daily. H. J. Tibbits, of Spokane, Washington is executive vice president of the operating company, **Spokane National Mines, Inc.**

A sapphire mining operation in Judith Basin County, Montana, is scheduled to be resumed by the **New Mine Sapphire Syndicate**, headed by Thomas P. Sidwell of Billings. Between the 1890's and 1930 over \$3,000,000 worth of stones have been mined from the deposit in the Yogo area, where operations were conducted by a British firm for several years.

Ben Rux and associates of Martinsdale are shipping some copper ore from the **Copper Butte** mine located 20 miles east of White Sulphur Springs in the Castle Mountains of Montana. The ore is mined in a small open pit.

The old **Keystone** mine near Superior, Mineral County, Montana, is yielding rich silver ore to Fritz Wilson, son of the late Fred Wilson, pioneer miner owner in the area. Ore is being trucked to the East Helena smelter.



Montana Steel Mill Moves Closer to Reality

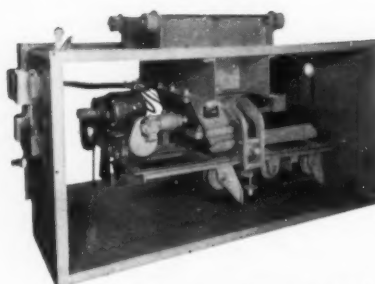
Construction of the proposed Anaconda, Montana, steel mill is expected to begin about May 1961, according to Webb & Knapp, Inc., of New York. A successful prototype test run of the Strategic-Udy process, which utilized Anaconda waste copper slag to produce steel, was recently completed in Niagara Falls, Ontario. Within a few months Koppers Company of Pittsburgh is expected to have completed engineering studies of the costs and operations procedure. Construction schedules will then be established. The mill is expected to cost \$40,000,000, will produce about 350,000 tons of steel ingot a year, and should be in operation by the end of 1963. The proposed location of the new steel mill is on a site adjoining the Anaconda Company slag pile and reduction works marked by the "X" in the above picture. The pile of waste copper slag contains about 40,000,000 tons, and is being added to at a rate of about 1,000 tons a day. The slag has an iron content of about 33 percent, plus 0.6 percent copper and 2.0 percent zinc. Webb & Knapp proposes to buy the slag for 25 cents a ton. By using the new Strategic-Udy process each 2½ tons of slag should yield about one ton of steel, 25 pounds of copper, 150 pounds of zinc oxide, plus other by-products. Webb & Knapp plans a similar operation at Clarksdale, Arizona, where they own a 30,000,000-ton pile of copper slag.

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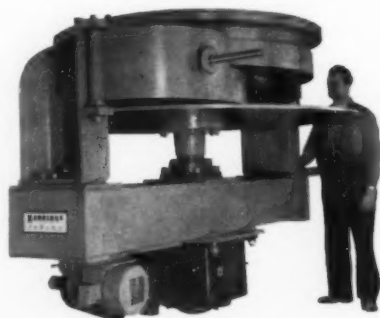
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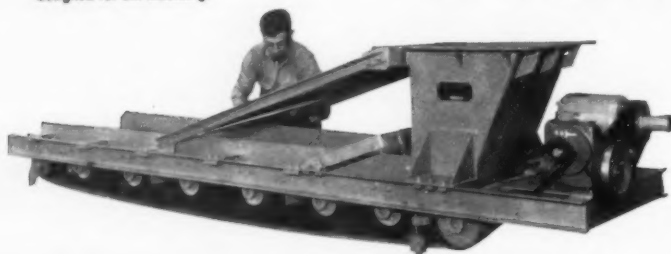


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Oregon

A 60-page booklet, "Gold and Money Session," published by the 1960 Pacific Northwest Metals and Minerals Conference, contains papers and statements by the eight mining and monetary experts who took part in the AIME conference held in Portland, Oregon, last April 28 to 30th. Copies are available for \$1.50 from the State of Oregon Department of Geology and Mineral Industries, 1069 State Office Bldg., Portland. Checks should be made payable to the 1960 Pacific Northwest Metals and Minerals Conference. The booklet includes introductory notes, the three papers presented at the morning session, the luncheon address, and a full transcript of the afternoon panel session.

Return of the White King uranium mine, Lake County, Oregon, to production next spring is planned by the new lessee, Vance Thornburg of Grand Junction, Colorado. Lakeview Mining Company's lease was dropped recently. Mr. Thornburg and his brother, the late Dr. Garth W. Thornburg, together with their associates, were original lessees of the mine from which Lakeview produced ore from 1956 through most of 1959.

Dave Chase of Medford, Oregon, is carrying out an exploration program at the War Eagle quicksilver mine in Jackson County, Oregon, and has moved his 10-ton Gould rotary furnace from the Bonita mine to the War Eagle. The lower drift and shaft have been opened and the upper drift extended eastward about 60 feet. Small amounts of the ore are being mill-tested.

Washington

At the Mount Spokane, Washington, district property of Daybreak Uranium, Inc., Herb Sams, Elk mining contractor, has been bulldozing through 30 feet of overburden to reach 10 feet of high-grade autunite indicated by downhole exploratory drilling. Kae Sowers of Opportunity, Washington, is company secretary-treasurer.

Clayloon Uranium Company has made initial truck shipments of lead concentrates from its new gravity-type concentrator at Leadpoint, northern Stevens County, Washington. The mill started operations on a one-shift basis. Flotation cells have been installed to recover fine lead particles which float off the jig table.

Spokane offices of the U. S. Bureau of Mines have been moved into a new building at Washington and Mission. One wing of the one-story concrete, brick and aluminum building houses the office of mineral resources, headed by R. N. Appling, and the other the office of mining research, headed at present by E. W. Parsons as acting chief. A laboratory and shop, rock crushing and grinding room, locker and shower room, photographic darkroom, drafting and copy room, conference and training room, a library and filing room and a reception room are among facilities. The structure has 40 rooms and 13,000 square feet of floor space. Two of the rooms have been taken over by the Northwest district staff of the Atomic Energy Commission.

Central

Engineering Studies Planned For Missouri Iron Ore Property

The long-range drilling program being undertaken jointly by American Zinc, Lead & Smelting Company and Granite City Steel Company in the Bourbon, Missouri area is beginning to show significant results. 18 holes drilled since the program started in 1956 now indicate the existence of a possible 100,000,000-ton deposit of iron ore. Exact size will not be known until about 25 holes are drilled.

An estimated outlay of \$25,000,000 to \$35,000,000 would be needed to develop a deep underground mine, build a 10,000-ton-per-day concentrating plant, and a pelletizing plant. Engineering studies are already underway to bring the mine into production and build the mill.

The iron ore at Bourbon lies from 1,700 to 3,500 feet below the surface, in thicknesses varying from 700 to 1,700 feet. It assays between 25 and 40 percent iron, compared with about 55 percent at the nearby Pea Ridge deposit now being developed by Meramec Mining Company. The Bourbon ore can be upgraded to about 65 percent for blast furnace charges. It could then be shipped to Granite City at a substantially lower price than that presently being paid for ore imported from the Iron Ranges, and from overseas operations.

Mining Research Symposium Convenes at Rolla, Missouri

The International Symposium on Mining Research, sponsored by the School of Mines & Metallurgy of the University of Missouri and the U. S. Bureau of Mines, Department of the Interior, will be held on the University campus at Rolla, February 22 through 25.

All presentations will be given in three languages (English, French, and German) by means of wireless translator equipment with individual earphones.

Among the interesting papers to be presented are these: Slurry Explosives Underground, D. T. Bailey, R. B. Clay, M. A. Cook, and D. H. Pack, Inter-mountain Research and Engineering Company; Blasting Ammonium Nitrate Fuel Oil Explosives Underground at Boliden, Ulf Henning, Bolidens Gruvaktiebolag, Boliden, Sweden; Influence of Explosive Composition on Blasting Results, N. V. Melnikov, Mining Institute, USSR Academy of Sciences, Moscow; Use of the Pneumatic Cartridge Loader in Rock Blasting, C. H. Johansson, Nitroglycerin AB, Stockholm, Sweden; Controlling Overbreak by Presplitting, R. S. Paine and D. K. Holmes, Explosives Department, Hercules Powder Company.

Factors Influencing the Life of Drill Steel Equipment, Curt Dahlin, Sandvikens Jernverks AB, Sweden; Effects of Transient Stress Waves in Rocks, John S. Rinehart, Director, Mining Research Laboratory, Mining Engineering Department, Colorado School of Mines; The Computation and Measurement of Stress Pulses in Percussive Drilling, H. C. Fisher, Atlas Copco AB, Stockholm; Methods of Studying the Strength of Rocks Used in the U.S.S.R., M. M. Protodyakonov, Professor, Mining Institute, USSR Academy of Sciences, Moscow; Rock Me-

chanics of Block Caving Operations, Seth D. Woodruss, civil engineer, Alhambra, California.

An open house at the Viburnum, Missouri, mine and mill of St. Joseph Lead Company recently gave the public an opportunity to see what is the world's most modern lead mill. Opened last summer, the highly automated mill is presently producing about 55 tons of 75 percent lead concentrate per day. The mill is designed to handle 6,000 tons of ore per day, with present equipment capable of milling 3,000 tons per day. Ore is presently being mined from Shaft 27 in Crawford County. Drifts are now being driven at Shaft 28 at the mill site, which was bottomed at 910 feet. A third shaft will be located near Courtois in Washington County. The entire operation at the mill is by continuous belt conveyor, from the dumping of the rock until the concentrate leaves the mill for the St. Joe smelter at Herculanum.

A symposium of more than usual interest to mining operators and management will be held March 1 in St. Louis, Missouri, as a joint session of the AIME and the Society of Economic Geologists. Subject of the symposium is "Mining Geology—Methods, Techniques, and Results." Dr. M. L. Jensen of Yale University is session chairman and Dr. J. D. Forrester of the University of Arizona is co-chairman for the Wednesday morning meeting. Mining geologists who will present papers include Frank Snyder and James Odell, who will discuss geological work at Bonne Terre, Missouri; Edward Shea, whose paper will deal with the use of geology at Butte, Montana; Arthur Baker of Callahan Mining Corporation on the role of mining geology and development at the Pitch uranium mine in Colorado; Roger Blais, who will report on geological work at the Quebec operation of Iron Ore Company of Canada, and Alan James, whose subject will be the use and application of geology at Kennecott Copper Corporation's open pit operations.

Eastern

Operations at the Lyon Mountain iron ore mine of Republic Steel Corporation in northern New York state have been temporarily shut down. The mine has operated only intermittently for the last few years, was opened this fall after a five-month shut-down, but closed again in November because of low demand.

Representative in the greater Philadelphia, Pennsylvania, area for Meehanite and Ni-Hard castings, machine shop and plate steel work, pattern-making and large custom machinery made by Hardinge Manufacturing Company of York, Pennsylvania, is Tom McKeown and Associates located at 47-2 Revere Road, Drexel Hill.

A firm organized recently in Yonkers, New York, The General Astrometals Corporation, will be the third beryllium producer in the United States. Centering much of its activities on powder metallurgy concerned mainly with missile and aircraft components, the company will start manufacturing beryllium products in Yonkers early this year, using ore from France that has been converted into flake or powder. The products will be made and sold under licenses from Pechiney of France, and will include cermets

and ceramics for high temperature and nuclear applications. General Astrometals will continue to make products previously supplied from the Yonkers plant of TRC Inc. and the American Electro Metals Corporation, and will sell beryllium metal items previously offered by International Selling Corporation, in which Pechiney has an interest. The country's two other beryllium producers are Beryllium Corporation of Reading, Pennsylvania, and Brush Beryllium Company of Cleveland, Ohio., whose combined annual sales are about \$50,000,000. Data on production and capacity of beryllium are classified because of its use in national defense.

Iron Ranges

Final figures for the 1960 shipping season from United States Great Lakes ports show that Eric Mining Company was the largest shipper, with 5,574,081 gross tons from Taconite Harbor during the season. Reserve Mining Company shipped 4,941,322 for the year, out of Silver Bay harbor. Comparative figures for 1959 were—Eric, 3,561, 376 tons, and Reserve, 3,640,088 tons. The 1959 season extended well into December, in order to make up for inactivity during the steel strike, while in 1960, much of the fleet was idle by mid-November. Total tonnage from U. S. ports for this last season was 65,903,096, and for the 1959 period, 42,651,729, including 3,110,281 tons during December.

During the winter season Jones & Laughlin Steel Corporation's Minnesota Ore Division plans stripping operations at its Lind-Greenway, Hill-Annex, and Schley mines and will make repairs to its various plants in the area. Construction of the company's Cretaceous semitaconite plant at Calumet, Minnesota, is proceeding on schedule toward completion in July. The plant will use autogenous grinding, followed by spirals. Later a regrind and a flotation section will be added. During the 1960 shipping season the division shipped 2,049,830 gross tons of concentrate, compared with 1,459,763 tons during the 1959 seasons.

The Champion mine of Copper Range Company near Painsdale, Michigan, is currently producing about 20,000 tons a month. This tonnage, combined with production from old tailing piles near the firm's Freda, Michigan, concentrator, results in a mill feed of about 55,000 tons.

Snyder Mining Company, which operates the Godfrey and Webb mines in the Hibbing, Minnesota, area, as well as the Whiteside at Buhl, is investigating low grade iron ore reserves near Butternut, Wisconsin. Shenango Furnace Company recently acquired entire ownership of Snyder, purchasing the 50 percent interest held by Crucible Steel Company.

A decrease of 10 to 20 percent is foreseen for Minnesota iron ore shipments in 1961 by Everett L. Joppa, general manager of the Lake Superior division of Pickands Mather & Co. The unpromising outlook for ore is based on current high inventories, low operating rate of steel mills, growing competition from other ore sources, and the low price of scrap iron which can be used instead of ore. Shipments of both regular ore and of taconite pellets from Pickands Mather operations in 1960 were less than anticipated.

Colorado

The Grand Junction (Colorado) Operations Office of the Atomic Energy Commission has distributed invitations to bid on approximately 1,500,000 pounds of fused vanadium pentoxide now stored at Grand Junction. Sealed bids will be received at that office until January 25, when they will be publicly opened. The material is available in 17 lots, ranging from about 29,000 pounds to 101,500 pounds, with an average size of 95,000 pounds. The V_2O_5 is in 30- and 55-gallon steel drums. It is part of the material purchased from the uranium processing mills during the last few years. Specifications and invitations may be obtained from the Grand Junctions Operations Office where the telephone number is CHapel 3-2110, Extension 466. In April, 1960, the Commission sold a similar amount at \$1 a pound.

A better quality of sulphur dioxide gas for the sulphuric acid plant of Rico Argentine Mining Company is provided by three new hearth-type roasters, which the company finished installing the end of December. In 1959 the company had installed a new electrostatic hot precipitator at the Rico, Colorado, plant which did not prove successful. Production of sulphuric acid during fiscal 1960 decreased because of mechanical trouble and a disastrous fire last January which destroyed the pyrite crushing plant, pyrite storage and accessory equipment, practically eliminating acid production for two months. The dust problem affected acid production and made necessary an unusual amount of maintenance on heat exchangers and related equipment. Production of acid during the year was 28,859 tons, compared with 39,529 tons in the previous fiscal year. Rico Argentine mined and milled 14,653 tons of lead-zinc ore from its Mountain Spring and Argentine area properties. The concentrator operated at about 40 percent of capacity. Concentrates containing the following values were shipped during the year: 1,810,095 pounds of lead; 1,281,562 pounds of zinc, 50,235 ounces of silver and 53.52 ounces of gold. The year's development work, 80 percent of it at the Mountain Springs mine, totalled 2,290 feet, comprising 1,823 feet of drifts and crosscuts, 984 feet of raising and 113 feet of long hole drilling. The remaining development was in the Argentine and Falcon sections of the firm's holdings. According to Sherman B. Hinckley, president, the company expects to produce profitably and do a reasonable amount of development work to maintain ore reserves under present conditions, even though the lead-zinc picture is not too promising.

Celebration of a three-year safety record for Trace Elements Corporation, a unit of Union Carbide Corporation, was marked December 9 by a company-sponsored dinner which some 175 employees and their families attended. The dinner in the Cosgriff Hotel, Craig, Colorado, noted the completion of a three-year period, in which Trace employees worked more than 750,000 man-hours without a disabling injury. Following the dinner, John Doyle, district mine inspector for Colorado, congratulated both management and personnel on the record and what it does to raise the standard of performance of the industry in Colorado. Responses to his talk were given by

D. M. Pembridge, plant superintendent, and Art Woods, mine superintendent. Several Union Carbide employees from Rifle and Grand Junction, Colorado, also attended the dinner.

Utah

Utah Copper Division of Kennecott Copper Corporation has begun its experiments in the use of oxygen smelting at its Garfield, Utah, copper smelter. A 20-ton test furnace started operations in November which, if effective, will reduce furnace processing time. Production at the smelter during 1960 was about 220,000 tons of anode copper and 220,000 tons of sulphuric acid. The Utah division is now using the 75,000 kilowatt addition to its central power station which was placed in service this fall. The addition cost an estimated \$16,000,000 and will supply enough electricity for a city of 350,000 population. A \$500,000 scrubber system recently completed at the smelter allows the plant to reuse water needed to clean sulphur dioxide gas. Previously carried away in water, the gas is now converted into about 50 tons of sulphuric acid daily. Waste water from the plant does not carry any substantial amount of sulphur dioxide fumes.

Beryllium Resources, Inc., is the surviving company in its merger with Dynamic Metals Corporation, which has developed a new flotation process for the concentration of beryllium minerals. Beryllium Resources is active in exploration and development of beryllium ores and is one of three United States companies producing beryllium metal, and its alloys and products. Brush Beryllium Company of Cleveland, Ohio, another beryllium producer, and E. Van Dornick of Dynamic Metals will acquire an interest in the surviving company. Other stock will be owned by Federal Resources Corporation and The Hidden Splendor Mining Company. President and chief executive officer of Beryllium Resources, Inc., is Bruce W. Odium of Los Angeles.

Equipment from the Monticello, Utah, uranium mill owned by the Atomic Energy Commission and from its multi-million dollar pilot plant at Grand Junction, Colorado, will be sold to present uranium operators, probably in "process units." The \$5,800,000 Utah mill, which has a capacity of 350 tons a day, was closed in June of 1958. The Colorado plant is the \$1,800,000 facility where the resin-in-pulp ore reduction process was developed. The Grand Junction AEC office reportedly has recommended that the two plants be sold in pieces and only to present operators since the properties are classified as "radioactive," though this does not mean they are unsafe. If it were possible to purchase the Monticello mill as a complete unit, the purchaser would probably have to have a uranium oxide sales contract, or else be able to expand production so that eventually the mill could handle uranium hexafluoride which, as a solid, could be sold directly to independent uranium metal manufacturers.

The recent discovery of beryllium-bearing minerals in the Topaz Mountain region of Utah is a development that could prove of major interest to the domestic supply situation, according to George S. Mihalapov, president of Brush Beryllium Company. Brush holds an interest in Beryllium Resources, Inc., which

controls leases and claims in the Topaz area, and has developed a new process for concentrating beryllium ore. Because the discovery is so new and there has been little drilling yet, the Topaz deposit is hard to assess, but Mihalapov said there may be anywhere from 2,000,000 to 10,000,000 pounds of contained beryllium metal in the entire Topaz area. Similar types of beryllium mineralization are being explored in Arizona, Nevada, Labrador, Alaska and Mexico.

The Radon uranium property near Moab, Utah, produced 39,821 tons of ore assaying 0.565 percent U_3O_8 during the first nine months of 1960. Tonnage from the Hot Rock property was 3,842 assaying 0.464 percent U_3O_8 . Hecla Mining Company, which operates the Radon property for Radorock Resources, Inc., received 25 percent of the credit for that property, while from the Hot Rock property, 2,746 tons were for Hecla's account.

Wyoming

The Diamond Alkali Company will reportedly begin development of a major trona property in the Green River, Wyoming area, where the firm has spent some \$1,000,000 to explore soda ash deposits. Development of a mine and a processing plant within 25 miles of Green River is expected. Allied Chemical Company is also said to be considering a soda ash development in the area. This firm reportedly has acquired trona leases southwest of Green River, and south of the mine and plant of Intermountain Chemical Company, a subsidiary of Food Machinery & Chemical Corporation.

Sinking of the first of two shafts at the trona project of Stauffer Chemical Company is under way, with the shaft collar set early in December. At the plant site, 21 miles northwest of Green River, Wyoming, two small buildings have been completed and preliminary work for the warehouse and shop building is progressing. The laying of rail for a 10-mile spur to connect the plant and mine with the Union Pacific Railroad began in December and steel for the railroad-highway bridge was to arrive soon after. The \$22,000,000 mine and plant are being constructed by Stauffer's West End Chemical Division. Winston Bros. Company of Minneapolis, Minnesota, has the prime contract for the project, scheduled for completion in 1962.

Bids for construction of a uranium mill for Petrotonics, Inc., near Shirley Basin, Wyoming, will be opened early this year. A pilot plant is now being built at Golden, Colorado, as a model for the mill which will employ a new process. It will be built near Petrotonic's open pit mine which was scheduled to start operations December 1.

By early December much of the grading and excavating had been completed for the \$60,000,000 Atlantic City, Wyoming, taconite project of Columbia-Geneva Division, United States Steel Corporation. Most of the rough grading for the 80-mile railroad to Winton Junction, and the concrete work for the railroad bridge was also finished. Several miles of railroad were completed before this phase of the project ceased for the winter. Shipment of pellets is scheduled to begin in 1962.

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Yes, there really was an "Armstrong" mucking machine, as many of you old timers will recall. It was the Shoveloder pictured above in the early 1920's. This old photograph was found recently in the mine office at Conda, Idaho by engineers of the J. R. Simplot Company which is now operating the Conda phosphate mine. The Armstrong was used by The Anaconda Company in driving the No. 1 lower adit, an 8- by 10-foot main haulage level. Anaconda operated the mine for many years until early 1959 when Simplot took over management and operation of the mine under long term contract. All mining is now by open pitting with shipments to both Anaconda and Simplot. In December 1926 the Armstrongs were replaced by Butler Model 199 mechanical shovels. Do any of you know what company built the Armstrong loader?

How Rotary Drilling Speeds Shaft Sinking

continued from page 25

within the mine has been neglected in these assumptions.

Still another method of making a hole between underground workings and the surface, often preferred for ventilation purposes by some mine operators in the Ambrosia Lake district, is by raising. A look at the ventilation raise in comparison with the data now available on rotary drilling shows that while the cost per cubic foot of material removed by the rotary drilling method is approximately the same, or less, there are other more complicated problems encountered with ventilation raises. For instance, it takes approximately four months to complete a lined 5 by 9 foot raise. Since it has a larger cross sectional area, fewer are needed to handle the volume of air required for ventilation. With only a few raises located throughout the mine, air distribution becomes somewhat more complicated. For example, approximately 200,000 cubic feet of air per minute can be circulated through a 5 by 9 foot raise.

On the other hand, although only about 40,000 cubic feet of air per minute is usually circulated through a 36-inch diameter rotary drilled

shaft, several smaller shafts can be strategically located throughout a mine for greater ease in air distribution. Also to be considered is the savings in horsepower requirements no longer necessary to move large volumes of air through many miles of underground airways, as well as the savings resulting from not having to maintain these airways.

In order to furnish mine management a ventilation system for the lowest total cost—shaft sinking and fan operation—additional work needs to be done. Many of the factors to be considered are:

1. The volume of air required for proper ventilation.
2. Resistance in the mine to the flow of air.
3. Resistance in the shaft to the flow of air.
4. Cost of the ventilation shaft.
5. Cost of fans to provide the air.
6. Cost of power to operate the fans.
7. The efficiency of the fan.

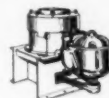
Judging from all indications, rotary-drilled shafts are economical, fast, and practical. The method employed by Rayco in sinking shafts for Kermac appears to be a major step in the evolution of shaft sinking. END

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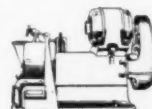
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Oceania

Union Carbide Prospecting Big Australian V₂O₅ Deposits

Union Carbide Corporation has geological crews evaluating its vanadium discovery in Western Australia. Both airborne and surface mapping and evaluation are underway to select the most promising deposits for further exploration and development. This vanadium mineralization together with ilmenite extends from Meekatharra to as far south as Norseman, about 400 air miles, but mineralization is by no means continuous.

Union Carbide discovered the vanadium during the last several years while it was examining manganese deposits in the Bilbara district. The manganese concessions were relinquished, but selection of the best areas within the large vanadium concession is being pushed. Several years ago Union Carbide controlled the United States Vanadium Corporation which was one of world's largest producers from Morrison formation deposits on the Colorado Plateau. These same deposits now furnish uranium with vanadium as a byproduct, with operations by Union Carbide Nuclear Corporation which absorbed USV.

Union Carbide also controls large vanadium deposits south of Eureka, Nevada. Carbide's geologist, Dean F. Frasche, is directing Australian exploration.

NEW SOUTH WALES—National Minerals Holdings Pty. Ltd. has reduced costs of recovering rutile and zircon by

12 percent through use of its new dredge, **The Titian**. The company produced 2,000 more tons of rutile and 1,000 more tons of zircon for the year ended June 30 than last year. According to R. A. Crowther, board chairman, the company has adequate reserves to meet the increasing world consumption of both metals.

REPUBLIC OF THE PHILIPPINES

—At the **Toledo** copper mine of **Atlas Consolidated Mining and Development Corporation** are treated in September totalled 254,754 tons averaging 0.58 percent copper. Total production of concentrates was 4,801.79 dry short tons assaying 26.96 percent copper and 0.136 ounce of gold per ton.

TASMANIA—A slight rise in production of tin and wolframite concentrate was achieved by **Aberboyle Tin Ltd.** for the fiscal year completed in June. The company produced 809 tons of tin concentrate and 345 tons of wolfram concentrate. Ore reserves of 258,359 tons are expected to be somewhat less next year. A program of diamond drilling and exploration is currently in progress.

NEW GUINEA—**Nippon Mining Company** of Japan is interested in known copper deposits northeast of Port Moresby on property held under option by **Consolidated Zinc Corporation**. The deposits are in the Laloki area where the existence of several hundred thousands of tons of pyrrhotite carrying up to 4 percent copper has been known for many years. This is the second time the Japanese firm has indicated interest in the property which is now being surveyed by S. Nakajima, geologist. The Laloki mineral oxidizes

rapidly and fires soon after mining. Tests over many years have not succeeded in development of a concentration process despite the high grade of ore.

SOLOMON ISLANDS—Greater progress in determining the mineral potentialities of the Solomons is seen with facilities provided in the new Geological Survey Department Building on Lengkama Ridge in Honiara. The building contains a geological museum; a rock stack with samples of minerals found in this British Protectorate and a map showing their location; a seismological recording room; a dark room; a drawing office; technical, optical, and chemical laboratories, and a petrological workshop. The Survey, which was founded in 1950, has explored and mapped the islands to indicate possible mineralized areas. In the future, the department will conduct more detailed investigations to aid private enterprise.

WESTERN AUSTRALIA—The group of companies included in **Western Mining Corporation Ltd.** mined 1,145,774 tons of gold ore during the year ended June 30, to produce 318,202 ounces of fine gold in bullion and concentrates. One firm, **Central Norseman Gold Corporation**, treated 183,697 tons to produce 101,115 ounces of gold, with an average yield of 11.01 dwts. per ton. Ore reserves are 504,000 tons averaging 9.2 dwts. Another member firm, **Gold Mines of Kalgoorlie**, treated 524,461 tons, producing 145,159 ounces of gold, with an average yield of 5.54 dwts. per ton. Ore reserves are 1,287,000 tons averaging 5.8 dwts. At Kalgoorlie, mine development during the year amounted to 33,318 feet; diamond drilling totalled 39,973 feet.

FIJI ISLANDS—The Mines Department welcomes mineral exploration of this colony where much of the land is virtually virgin territory in terms of modern prospecting techniques. Exclusive terms would be offered to any firm that makes a substantial investment in exploration here. Japanese interests have conducted drilling programs for copper for some time, with encouraging results, giving rise to speculation that Fiji could become another Philippines for Japan. **Emperor Mines Ltd.** continues its gold mining operations with most activity in the Vatukoula area.

REPUBLIC OF THE PHILIPPINES—**Samar Mining Company** has placed into production a copper mine located about three kilometers from its central Masara mill at Davao, Mindanao. The ore assays about 1.5 percent Cu, with gold and silver values. Surface mining methods are used, since the topography is favorable and the 50-foot-wide ore body lends itself to this method. Very little overburden caps the ore body and some tonnage of oxidized copper material is available for leaching. Samar is making a study of small leaching operations in order to experiment on the feasibility of undertaking such a project.

VICTORIA—**Gold Mines of Australia**, a subsidiary of **Western Mining Corporation Ltd.**, is continuing its rather limited investigation of gold bearing areas near Stawell and Clunes. The company has completed about 12,000 feet of drilling in the last three years. Although several mineralized reefs have been intersected in both areas, assays to date have been low.

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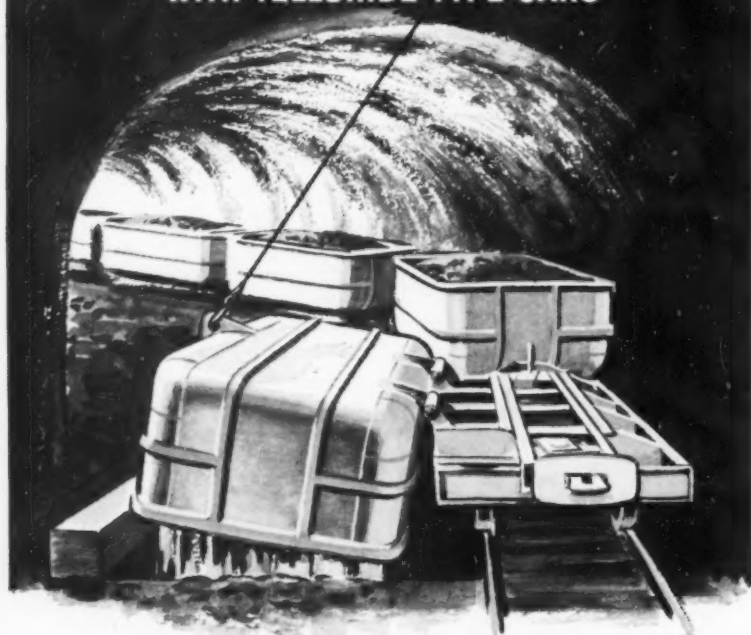
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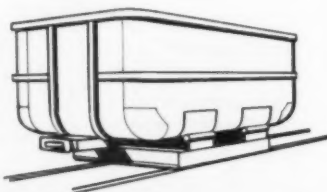


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Latin America

BOLIVIA—Discussion about construction of a tin smelter in Bolivia was revived recently with the reported offer by Nikita Khrushchev to back such a project. The subject has received much attention in the press, with rumors that the United States and Messrs. William Harvey of Liverpool, England, had made counter-proposals following the Soviet offer. Technical and economical aspects of a Bolivian smelter have been under study for many years, but no feasible solutions to the many problems seem likely. Some of the factors to be considered are the huge operating capital necessary, assurance of market facilities, current long-term contracts with smelters which could not be easily cancelled, and insufficient proven tin ore reserves to justify the investment required. The fact that most Bolivian tin ore is of low grade and must be mixed with higher grade ore in smelting is another drawback, as is the difficulty of hiring expert metallurgists for the complicated operations in Bolivia.

ARGENTINA—A new company called Talamuchita SAIC has been formed in Villa Maria, Province of Cordoba, to develop and mine deposits of ilmenite, scheelite, monazite, rutile, zircon, garnet, and other minerals of value said to exist in this area.

MEXICO—Zincamex, S. A. has selected a site for its zinc refining and sulphuric acid plant in Saltillo, Coahuila. The zinc refinery will have a yearly capacity of 30,000 tons of special high-grade zinc, and the acid plant will produce 60,000 tons of 100 percent acid per year. S. A. Sybstra of Brussels, Belgium, will build the plant which will use the Overpelt-Lommel process for producing zinc.

CHILE—An investment of \$3,000,000 is planned by **Compania Minera Santa Fe** this year in development of the **Carmen** mine (El Salado). Earlier development work is expected to bring production at the mine to 700,000 tons yearly, starting this year. The company also plans to spend about \$12,000,000 in the next three years to increase production at its other iron properties, since it hopes to ship 15,500,000 tons of ore during the next five years to the **Canadian Foreign Ore Development Corporation Ltd.** These exports will consist of 10,000,000 tons of open hearth ores, 5,000,000 tons of low grade, and 500,000 tons of fines. Shipments are scheduled to begin this year with 1,000,000 tons and increase by 1963 to 4,300,000 tons a year.

CHILE—Mining at the **El Algarrobo** deposit of **Compania de Acero del Pacifico** is expected to start early in 1962, with a yearly output of about 1,200,000 tons. The project, which is being implemented by an Export-Import Bank credit of \$15,600,000, includes construction of a mechanized port south of Huasco.

PERU—Two Japanese mining firms, **Mitsui Bussan Kaisha Ltd.** and **C. Itah Company Ltd.** have established offices in Lima as headquarters for extensive exploration and prospecting by Japanese and Peruvian geologists. A geological team from the Mitsui concern has been investigating the Mala region in the Province of Canete where the **Bujama** copper

mine is located. This mine, formerly owned by Laonidas Vanini, was recently sold to a group of prominent United States mining men located in Peru. An extensive drilling program undertaken by this group at Bujama indicated that copper properties located in the coastal region are apt to contain sulfides in addition to the usual copper oxides previously thought to be the only copper minerals in this region.

HONDURAS—Honduras Mining and Development Company is continuing the trenching program begun early last year on its claims on Quita Gana Mountain about 100 miles northwest of Tegucigalpa. Surface sampling indicates high grade magnetite in the three deposits on the property.

CHILE—Compania Minera Tamaya of Chile and The Mansfeld A.B. of Hannover, Germany, mining subsidiary of Salzdethfurth A.G., have signed a contract for exploration and development of Tamaya's copper property, El Rosario, of Andacolla, in the Province of Coquimbo. The deposit, located about 3,000 feet above sea level, reportedly has reserves of 100,000,000 tons of ore with 1.5 to 2 percent Cu. Present plans call for a two-year program of exploration and development in preparation for an open-pit operation that will produce 10,000 tons of ore daily. Tamaya purchased the property for \$2,000,000 last summer.

PERU—High gold values have been recovered from the churn-drill holes in the Inambari River area where South American Placers Inc. has leased several gold placer claims. The company has drilled over 100 holes in the southeastern Peru property owned by Sixto Gutierrez.

BOLIVIA—Construction of a copper ore processing plant with a monthly capacity of 10,000 metric tons is scheduled for completion in 1962. The plant will be built in the Chacarilla region where Nitto Boliviana Mining Company recently purchased mining rights.

PERU—Mitsui Bussan Kaisha Ltd. of Japan has taken a purchase option on the Cimarron porphyry copper prospect in the San Jose area, Department of Arequipa, in southern Peru. A 15,000-foot drilling program will start soon on the property on which both Cerro de Pasco Corporation and Kennecott Copper Corporation formerly held options. Both United States firms dropped their options after undertaking short drilling programs.

CHILE—An exploration and drilling program begun by The Anaconda Company is designed to determine the reserves of copper in the El Sauce mine and surrounding area. Anaconda took a three-year option on the property owned by Beltran Amenabar C. (Amenabar, Abbot and Company) last year, and is expected to purchase the promising prospect located in the same district as the Tamaya copper property.

ARGENTINA—A farewell party was given in Chilecito, La Rioja, by the Empresa Minera Juan y Carlos G. Casale for Dr. Horst Poetter, head of the mine planning section of the Rheinstahl Industrie Planung of Dusseldorf, West Germany. Dr. Poetter spent several weeks in Argentina studying the country's mineral resources with particular emphasis on the extensive asbestos deposits in the region of Jaque, Province of La Rioja. Over 100,000,000 tons of chrysotile asbestos have reportedly been located in this area.

Asia

PAKISTAN—The International Co-operation Administration in conjunction with the United States Geological Survey has begun an exploration program in the chrome ore district northeast of Quetta. The entire district will be mapped in the project on which both foreign geologists and those from the Geological Survey of Pakistan, are engaged. Investigations are also being carried out in West Pakistan where a chrome deposit was located near Peshawat recently. A private company is exploring in this area.

JAPAN—Taio Mining Company, a subsidiary of Sumitomo Metal Mining Company, has completed construction of

a cyanidation plant at the Taio mine in Obita Prefecture on Kyushu Island. The 200-ton-capacity plant treats 8.8 grains-per-metric-ton gold ore from the mine, which produces 1,500 metric tons of ore per day. Monthly output from the new plant is 50 kilograms of gold, giving the company a total monthly output of 100 kilograms from this operation and from the Ohguchi plant in Kagoshima Prefecture, also on Kyushu.

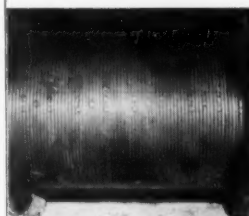
MALAYA—Kamunting Tin Dredging Ltd. expects dismantling of its No. 6 dredge to begin the second half of this year in preparation for transfer to an area acquired from Taiping Rubber Company, where reserves will probably last through 16 years of operation. The company expects to keep its No. 5 dredge at its present location until about April

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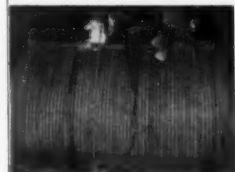
(1) Shows a 60" by 90" helical grooved steel drum before installation of LeBus Counterbalance Spooling system.



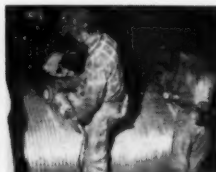
(2) Installation of one-half of steel split sleeve being welded and bolted over old drum core.



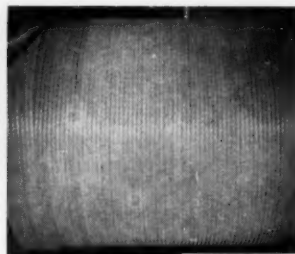
(3) Second half of steel split sleeve being put in place before welding to drum core.



(4) Installing LeBus grooved segments over split sleeve by method of welding firmly to the drum.



(5) View of completely restored drum being finished by grinding welds smooth in preparation for spooling the line on drum.



(6) Showing 8500 feet of 1-1/2" wire line being spooled on seventh layer successfully and safely by LeBus Counterbalance Spooling System.



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1962, if certain marginal ground proves profitable. Then it will be moved to the Eastern Tailings area for service of about 10 years in reasonably profitable ground. Kamunting's old small-capacity No. 4 dredge is presently on a care and maintenance basis.

MALAYA—A 25 percent interest in Malaya's largest bauxite mining company, **South-East Asia Bauxites Ltd.**, has been acquired by the **Nippon Light Metal Company** of Japan from its Canadian partner, **Aluminium Ltd.** of Montreal. Southeast Asia Bauxites holds mining leases that cover 6,000 acres in the Kota Tinggi district of Johore state and last

year produced 200,000 long tons of the country's total production of 381,747 long tons of bauxite. Output this year is expected to reach 300,000 long tons. Malaya's other bauxite mining firm, **Ramunia Bauxite Ltd.**, operates in an adjacent area.

ISRAEL—During a recent visit to the United States, M. Bentov, Israel's minister of development, granted rights to prospect part of Israel's phosphate deposits to an unnamed United States firm. The agreement provides that the company spend at least \$250,000 on the program during the next two years. If exploration warrants it, the firm will invest up to \$8,000,000 in construction of a processing plant with a yearly capacity of 500,000 tons of phosphates, plus several hundred thousand tons of phosphate-

based cattle feed. If the project develops, Israel will receive royalties at the rate of 7½ percent. When the output of the proposed plant reaches 600,000 tons annually, Israel is to build a railroad to the Red Sea port of Eilat.

IRAN—The Ministry of Industry and Mines in Teheran has engaged three French experts to advise on development of mining activities. The advisers, Messrs. Barian, Ziegler, and Bornou, are specialists in petrography, radioactive minerals, and ore dressing, respectively.

INDIA—Development of iron and bauxite occurrences in the Shevroy Hills of the Salem district in South India and parts of the Nilgiris district has been under study by Lawrence Blade of the United States Geological Survey, who previously surveyed areas in Himachal Pradesh and Madhya Pradesh. Mr. Blade, who has been an adviser to the Geological Survey of India for the last two years, reports that the occurrences are fairly widespread, meriting exploration and possible development.

MALAYA—The mineral wealth of the Kinta Valley tin field, one of the richest and largest single alluvial tin deposits in the world, is still far from exhausted after 75 years of intensive mining. However, an immediate extensive prospecting program is required to insure production continuing at its full potential, according to a new report prepared by the Federation of Malaya's Geological Survey. The authors, Dr. F. T. Ingham and E. F. Bradford, say the length of life at the Kinta field will depend on possible undiscovered deposits; more efficient methods of prospecting, mining and extractive recovery; a sound government land use policy; stability of the tin market, and international politics. Diamond drilling and geochemical prospecting are suggested as methods for locating underground lode tin ore deposits in the valley.

INDIA—Sikkim Mining Corporation has been organized recently to develop copper reserves in Sikkim State as part of the Indian government's program for accelerated development of non-ferrous metals. Only copper production in India at present is from Chatsila in Bihar State, an output of 8,000 tons of refined copper per year. Major requirement of the country is for electrolytic copper.

MALAYA—An all-time production record of 6,000,000 tons of iron ore may have been set in 1960, according to early indications. If so, the industry would make about \$60,000,000 (Malayan) more than during 1959, when about \$120,000,000 worth of ore was produced.

JAPAN—Two copper companies, The Furukawa Mining Company, and the Mitsui Metal Company, will build new refineries to meet Japan's demand for electrolytic copper which is expected to reach 240,000 tons for the fiscal year ending next March. Furukawa will build a plant with a capacity of 1,000 tons per month in Chiba Prefecture. Mitsui's refinery will be of 1,500-tons-per-month capacity. Both will be in coastal areas to facilitate handling of imported ore and concentrates.

INDIA—Production of iron ore in the first nine months of 1960 was 7,967,000 metric tons, 39 percent higher than in the corresponding period of 1959. September's output was 835,000 metric tons.



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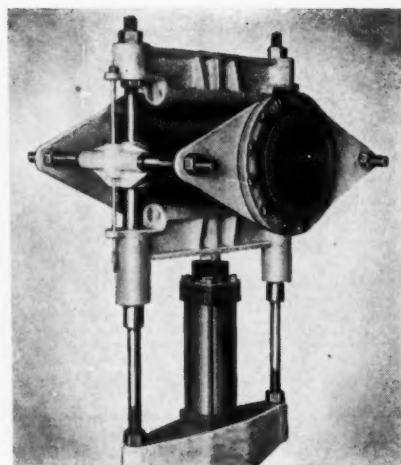
NEWFOUNDLAND—An \$18,000,000 project undertaken by a group of Canadian and European firms will bring about development of an asbestos ore body in the Baie Verte region of the Burlington Peninsula in northern Newfoundland. Mineral rights to the area are held by Advocate Mines Ltd. through a concession granted by the government in 1955. The investors group includes Canadian Johns-Manville Company Ltd., Patino of Canada Ltd., Amet Corporation, Inc., and Financiere Belge de L'Asbest Ciment, S. A., with Johns-Manville to provide 49.62 percent of the investment required, and to manage and operate the project. Development plans follow a two-year \$1,750,000 program of extensive exploration, test mining and core drilling, which will be continued. Proven ore reserves of the explored deposit have been estimated at 22,000,000 tons. The asbestos fiber is chrysotile type, with most of a high quality, relatively long Grade 4 fiber. The project will include construction of a mill at the mine site, crusher building, a warehouse, and a service building, a road from the mine to the water front and a dock to provide for loading of ocean-going ships. The mill is expected to be ready for commercial production by mid-1963.

BRITISH COLUMBIA—At the Fifteen Mile Creek gold placer property of Skookum Uranium, Inc., pay dirt has been reached and a dragline for mining is being installed. The pay streak has been uncovered for a width of 20 feet and appears to be over four feet in depth. The gold occurs in a layer of gravel on bedrock below layers of consolidated silt. It was reached by bulldozer trenching. According to T. A. Tester, of Spokane, Washington, president, the gold is of high fineness. E. G. Timmons is mine superintendent and Robert N. Roby, geologist.

SASKATCHEWAN—Shaft sinking by International Minerals & Chemical Corporation (Canada) Ltd. at its potash mine near Esterhazy is now more than halfway through the water-bearing Blairmore sands and proceeding satisfactorily. The 200-foot Blairmore was frozen a year ago at about minus-50° F. A cast iron lining is being installed in five-foot rings, 11 segments to a ring, simultaneously with the shaft-sinking, to assure maximum safety and uninterrupted production after the shaft is completed. Once through the Blairmore sands at about 1,450 feet, the shaft will be sunk through limestone strata to the potash deposits which are located at about 3,150 feet. Start of production at the mine is scheduled during fiscal 1961-1962. Construction of a surface refinery is nearly completed. (See MINING WORLD, April 1960, page 56).

QUEBEC—Encouraging results are reported from the ground geophysical work which Southwest Potash Company is carrying out on the Mattagami area copper property it has optioned from Lynx Yellowknife Gold Mines Ltd. An induced polarization survey has been started to check previous results, and drilling will probably be carried out later this year. Southwest Potash, a subsidiary of American Metal Climax Company, has agreed to spend \$150,000 in the next five years on the property consisting of 46 claims in Galinee Township, about three miles south of Mattagami Lake. In 1959 nine

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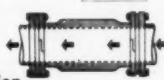


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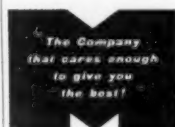
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shallow holes were drilled on part of the property. Most of these encountered sulphides and the first four, drilled over a length of 300 feet, indicated significant values in copper as well as some zinc. The geophysical work recently underway included magnetometer and electromagnetic surveys.

BRITISH COLUMBIA—Consolidated Mining and Smelting Company of Canada Ltd. is building a concentrator at the Benson Lake property on northern Vancouver Island that will treat 750 tons of copper per day. Ore will come from the Coast Copper Mines Ltd. mine on the property, which will be brought into production. The Benson Lake site is about 50 air miles from Port Hardy and 25 land miles southwest of Port McNeil. Preliminary work will continue through the next two years, with concentrate production scheduled for early 1962. Coast Copper was organized in 1916, but its mine has never been in production. Ore reserves are estimated at 2,000,000 tons assaying 2.5 percent Cu.

NEW BRUNSWICK—Kennco Explorations (Canada) and Mount Pleasant Mines Ltd. have resumed drilling on the latter's property near Mount Pleasant in Charlotte County. By December 1, 8,076 feet of drilling had been completed on the main molybdenite-tungsten-tin-zinc prospect where intensive geological work has been carried out the last several months. Encouraging results were obtained in the drilling program. Average width of zones probed is about 14.6 feet, but several are more than 20 feet wide. Most of the zones are in the Fire Tower area in the south central portion of the property where 5,868 feet of drilling has been done. This area seems to have a greater potential for molybdenite and tungsten, but interesting tin values are also indicated. In the North area, the zones generally have higher tin values.

BRITISH COLUMBIA—The provincial government has cleared the way for increased iron ore prospecting and production by providing that anyone now can claim an iron ore discovery by paying a royalty of \$1.00 per ton on production. Formerly it was impossible to obtain title to an iron ore deposit. British Columbia ore containing 62 percent iron now is being sold to Japan for about \$9.70 a ton, compared to a one-time market of only \$3.50 a ton.

ONTARIO—The International Nickel Company of Canada Ltd. has started expansion of its iron ore recovery plant at Copper Cliff that will triple capacity to 900,000 short tons of iron ore pellets a year. The program will cost some \$50,000,000, of which about \$10,000,000 is scheduled for this year. The process to be used at the plant was invented by the company's research staff and involves solid state pyrometallurgical operations and the removal of nickel by atmospheric pressure leaching, in high capacity units of novel design. The expanded plant will treat 1,200,000 short tons per year of nickeliferous pyrrhotite, high in iron. Diversion of the large quantity of pyrrhotite to the iron ore recovery plant will decrease by 40 percent the tonnage of material to be handled by the nickel section of the Copper Cliff smelter, resulting in important economies.

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Europe

YUGOSLAVIA—Recent development work at the **Ajvalija** and **Kisnica** lead-zinc mines near **Pristina** has increased reserves to about 10,000,000 tons of ore which averages 3.56 percent Pb and 1.85 percent Zn, with 51 grams of silver per ton. An accelerated program is planned for these mines because of decreasing output from the **Novo Brdo** and **Rudnik** mines. The project calls for future production of 610,000 tons a year, which is nearly equal to the output from the **Trepca** mines. A flotation plant with crushers will also be built, since the **Ajvalija-Kisnica** ore is not particularly amenable to treatment at **Trepca**, and must be crushed twice to achieve an 86 percent -200 mesh screen.

UNITED KINGDOM—The refusal of the Oxford County Council to allow open-pit mining in Oxfordshire because it would be a threat to the countryside is the subject of inquiry by the Ministry of Housing. Proponents of the application of **Richard Thomas and Baldwins** to mine in the Banbury area cite the nearby ore-field at **Wroxton** where the countryside was far from beautiful when the work began, and where the land is of little agricultural value. It is also claimed that work of restoration at Banbury would be more carefully carried out than it ever has been before. The present dispute is receiving extensive press coverage because of the vital issue of natural beauty versus industrialism.

NORWAY—Plans for construction of a steel mill at **Narvik** are progressing satisfactorily and building may begin next spring. The plant will use Swedish iron ore from **Kiruna** to produce a steel powder that will be pressed into steel blocks for export.

PORTUGAL—Extensive sampling from selected raises at the **Vale da Ermita** mine section of **Beralt Tin & Wolfram Ltd.** has confirmed that the orebody is of low grade with only sporadic zones of dense mineralization, so that continued underground mining will be unprofitable. The **Argimela** orebody about 25 miles away, however, appears more promising, with good prospects for a large scale open-pit mining operation. Investigations are under way in regard to the heavy capital outlay such a project will require.

EIRE—**Magnet Cove Barium Corporation** of Houston, Texas, will exercise its option on property in the **Ballynoe** area for which **Silvermines Lead and Zinc Company Ltd.** has leased mineral rights. **Magnet Cove** has carried out an extensive drilling program on the property and will spend not less than \$400,000 in the first five years for mining and shipping of barites. **Silvermines Lead and Zinc** will be paid \$1.00 per ton of ore mined and shipped, or sold. Although the agreement calls for **Magnet Cove** to mine and ship or sell a minimum of 50,000 tons a year starting in 1961, the company at present plans a yearly production of 80,000 to 100,000 tons.

YUGOSLAVIA—The separation plant near the **Deva** chrome mines in **Djakovica** is being remodelled to increase production of coarse concentrates for which there is an extensive domestic demand. The plant, built in 1954, has a capacity of 70 tons of ore per 24-hour day, producing two sizes—under 1.5 millimeter

and under 4 millimeter. The mine began operation in 1930 and during the Italian occupation of World War II most of the first class ore was mined. Operations were resumed in 1948 and production now is mainly second class ore and concentrates. However, the present ore grades 43 to 45 percent Cr_2O_3 with only 5 to 6 percent SiO_2 . Present reserves are sufficient for about five years of operation, but exploration for additional reserves is being continued. Transportation has been a principal difficulty, but completion of the **Pec-Prizren** railroad line next year will solve this.

RUSSIA—Development work has begun on another large iron deposit that was located recently about 250 miles southwest of Moscow. Initial estimates of reserves are said to be 300,000,000 tons of ore that is similar to Swedish ores with a content of between 56 and 69 percent Fe. Production of 36,000,000 tons of ore per year is planned by 1965.

FINLAND—A plant to process iron ore from the **Jussaro** deposit is being built at **Koverhar** in southwestern Finland by **Oy Koverhar Ab**, a Finnish-Swedish company. Production capacity will be 250,000 tons of pig iron yearly, with operations scheduled to begin this year. The **Jussaro** deposit has estimated reserves of 200,000,000 tons.

SWEDEN—Estimates of iron ore production for 1960 indicate a new record of close to 21,000,000 tons. The expected export tonnage figure for the year is 18,000,000 compared with 15,600,000 in 1959. According to a new inventory, iron ore deposits in central Sweden contain an estimated 650,000,000 tons of ore, equal to 255,000,000 tons of iron. An inventory in 1950 set the figures at 400,000,000 and 150,000,000 tons.

NORWAY—**Christiana Spigerverk** is scheduled to start mining of nepheline-syenite near **Hammerfest** in northern Norway early this year. Initial annual output will be 45,000 tons of ore for use in the glass and ceramic industries. The company is constantly increasing production from its **Roodsand** iron mines and its **Bremanger** iron smelter, both in western Norway.

SWEDEN—**LKAB** is negotiating with Norway to build another ore-loading port in **Rombakstbotn** to handle ore from the new mines in **Swappavara**. The new port would be connected with a tunnel near **Bjoernfaell** on the Swedish-Norwegian border and ore bins blasted out of the mountainside. At present, ships of up to 70,000-ton capacity can enter the new **Rombakstbotn** harbor for direct loading by belt conveyor. **LKAB** is also financing construction of new port facilities in **Lulea** in northern Sweden, a project costing about 150,000,000 Swedish crowns. Total production of **LKAB** mines is expected to reach about 20,000,000 tons per year by 1965.

YUGOSLAVIA—Two plants to be built near the **Trepca** mines will use lead and zinc produced at the **Trepca** operation. One, located at **Kosovska Mitrovica** about four miles from the mines, will manufacture lead batteries at the rate of about 6,000 tons a year. The second is a zinc electrolysis plant expected to use almost the entire **Trepca** zinc ore production. Yearly output at this plant will be about 18,000 tons of electrolytic zinc and 40,000 tons of sulphuric acid for later use in manufacturing fertilizer.

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Full 360° swivel head permits drilling at any angle. The hinged drill head swings out of the way and the powerful drum hoist conveniently lifts or lowers drill rods when adding or removing drill rods.



A drum hoist, with ample fairleads and pulleys for winching the rig into position, makes the Hillbilly "the drill you can take with you!"

Africa

UNION OF SOUTH AFRICA—Representatives of the United States and British Combined Development Agency and the South African Atomic Energy Board are discussing the status of uranium oxide contracts for South African companies. The contracts, which will expire during the 1963-1967 period, may remain in force as they are, or they may be amended to provide for a stretch-out operation. The present conferences have given rise to speculation about whether companies whose main income derives from gold, rather than uranium, will temporarily suspend uranium production in favor of those companies which are almost completely dependent on uranium for income. At present the total amount of uranium oxide contractual sales is 6,200 tons a year. Mines most dependent on uranium production are Afrikaner Lease Ltd., Daggafontein Mines Ltd., Welkom Gold Mining Company, Luijpaards Vlei Estate and Gold Mining Company, Vogelstruisbult Gold Mining Areas Ltd. Virginia Orange Free State Gold Mining Company Ltd., Fredries Consolidated Mines Ltd., Randfontein Estates Gold Mining Company, East Champ d'Or Gold Mining Company Ltd., Dominion Reefs (Klerksdorp) Ltd., and West Rand Consolidated Mines Ltd. Two other companies, Harmony Gold Mining Company Ltd., and Loraine Gold Mines Ltd., are also quite dependent on uranium earnings, while Western Reefs Exploration and Development, President Steyn Gold Mining Company Ltd. and Doornfontein Gold Mining Company Ltd., would be seriously affected were their gold grade to decline appreciably. Relatively high gold producers which could increase production if uranium earnings declined or were suspended include Vaal Reefs Exploration and Mining Company Ltd., President Brand Gold Mining Company Ltd., Blyvooruitzicht Gold Mining Company Ltd., West Driefontein Gold Mining Company Ltd., Hartbeestfontein Gold Mining Company Ltd., Buffelsfontein Gold Mining Company Ltd., and Stilfontein Gold Mining Company Ltd.

FEDERATION OF RHODESIA & NYASALAND—An informative booklet "Chromium in Southern Rhodesia" has been prepared by the Department of Mines of Southern Rhodesia. For additional information write to The Secretary, Ministry of Commerce and Industry, P. O. Box 8019, Causeway, Salisbury, Southern Rhodesia.

GHANA—A sharp setback in operations at Ariston Gold Mines (1929) Ltd., has resulted from a breakdown in the central shaft electrical hoist equipment. Repairs to the shaft between the 10th and 12th levels are also required. Further repairs that will restrict output may be needed within the next few months until the permanent repair program is completed.

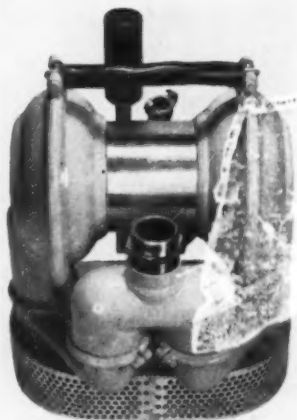
SWAZILAND—First delivery of ore from the Mbabane district iron ore deposits is scheduled for 1964, according to negotiations nearing completion between Anglo American Corporation of South Africa and Guest Keen & Nettlefolds on one hand, and a Japanese group representing the Yawata Iron & Steel Company and the Fuji Iron and Steel Company on the other. The Japanese

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group, in which the Mitsui and Kinoshita concerns have a 20 percent interest, will purchase 1,200,000 tons of Swaziland iron ore annually for the next 10 years. The agreement calls for development of three mining areas on the Bomvu ridge near Mbabane, this country's principal town. The mining operation will cost between \$8,000,000 and \$11,000,000, while the contract with the Japanese calls for payment of nearly \$12,000,000 per year at the rate of 70 shillings per long dry ton of 65 percent Fe ore. The project also involves construction of a railroad to link the mine with Lourenco Marques through the existing railhead at Goba in Portuguese East Africa. Rail construction will be financed for the most part by the British government. Most of the mining equipment will probably come from the Union of South Africa, as well as rolling stock for the railway. As the main supplier of most goods at Swaziland, South Africa will also profit from the extensive project.

UNION OF SOUTH AFRICA—Kennecott Copper Corporation of the United States is reportedly negotiating to dispose of its substantial holdings in two South African gold mining firms, Virginia Orange Free State Gold Mining Company Ltd. and Merriespruit (O.F.S.) Gold Mining Company Ltd. Kennecott's interest in the two firms, whose properties adjoin, amounts to about \$47,000,000. The company will presumably take a loss in disposing of its holdings, since neither company has operated to make anticipated profits. Production at the Merriespruit Mine began in March, 1956, but was suspended the following October because of flooding. Initial plans

to drain the water into the neighboring Virginia mine were abandoned because gold prices did not justify the cost involved. Profits from the Virginia mine last year were termed "disappointing" because of increased production costs caused by the lower grade of the ore. Production from the Virginia mine in 1959 amounted to 367,389 ounces of gold, 649,736 pounds of uranium oxide, and 132,065 tons of sulphuric acid.

MAURITANIA—A group of three companies will build the 400-mile railroad from Fort Gouraud to Port Etienne that is part of the \$190,000,000 project of developing the Kedia iron deposits. The firms involved in the railroad construction are the Societe Dragages et Travaux Publics, the Compagnie Industrielle de Travaux; which is a subsidiary of the Compagnie Schneider, and the Societe des Grands Travaux de Marseilles. The development is a project of Societe de Mines de Fer de Mauritanie (MIFERMA). Reserves at the deposit on the edge of the Sahara are estimated at 150,000,000 tons of ore containing 63 percent iron. Financing for the program comes from a \$66,000,000 loan from the International Bank for Reconstruction and Development, from the French government, and from the Caisse Central de Cooperation Economique.

UNION OF SOUTH AFRICA—Performance of the new multi-rope hoist devised by Robert Blair is being studied at President Brand Gold Mining Company Ltd. where this type of hoist is in actual use for the first time. Installed at the President Brand No. 3 shaft, it is able to hoist a 10-ton ore payload from a depth of 5,250 feet at 3,000 feet per minute.

Considerably smaller ropes than usual are used on the hoist since it uses two ropes. The hoist has greater braking control and more effective braking reaction without motion loss because its Blacks brakes are applied by springs, and released by hydraulic pressure. Another advantage is that it needs no tail rope to compensate for dead rope weight since its operation is similar to a conventional double drum hoist. The machine was devised by Mr. Blair, who is consulting mechanical engineer for the Orange Free State mines of Anglo American Corporation of South Africa. Experiments at Western Reefs in converting a conventional hoist led to the permanent installation of the multi-rope equipment at President Brand.

FEDERATION OF RHODESIA & NYASALAND—Nchanga Consolidated Copper Mines Ltd. has begun an \$8,400,000 project to expand its leaching plant. The first phase of the program will include addition of a roasting plant for conversion of sulphide concentrate to a calcine which can be treated in the leach plant. Scheduled for completion by December, 1962, the first stage also calls for extensions to the existing plant to reduce entrained copper losses, and extensions to the tankhouse, which will increase capacity of the leach plant by some 1,000 tons a month. The project's second phase includes additional leach plant equipment to permit treatment of low-grade oxide concentrates; a second-stage filtration circuit to improve recovery in the high-grade circuit, and additional electrolytic cells in the tank house. This second phase will increase plant capacity by another 1,000 tons a month if present tests prove successful.

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Metal & Mineral Prices

U. S. A.

December 23, 1960

METALS

COPPER: Electrolytic, Delivered F.o.b. cars, Valley basis (pound)	30.00¢
Lake, Delivered, destinations, USA	30.00¢
F.o.ign. Delivered, destinations, USA	30.00¢
Lead: Common Grade, New York (Per pound)	11.00¢
Tri-State Concentrate, 80% lead, per ton	\$139.50
ZINC: Prime Western: F.o.b. E. St. Louis (Per pound)	12.00¢
Prime Western: Delivered New York	12.50¢
Tri-State Concentrate, 60% zinc, per ton	\$72.00
ALUMINUM: Primary 50 Pound Ingots (99.5% plus) (Per pound)	26.00¢
ANTIMONY: Lone Star Brand, F.o.b. Laredo, in bulk (Per pound)	29.50¢
BISMUTH: (In ton lots) price per pound	\$2.25
CADMIUM: Sticks and bars, 1 to 5 ton lots Price per pound	\$1.60
COBALT: 97-99%, keg of 500 pounds (Price per pound)	\$1.50
COLUMBIUM: Ingot	Nominal, per pound \$36.00-\$55.00
GERMANIUM: dioxide, high purity, gram	16.75-21.75¢
LITHIUM: 98% (per pound)	\$9.00-\$12.00
MAGNESIUM: Ingots (99.8%) F.o.b. Velasco, Texas per pound	36.00¢
MERCURY: Flasks, Small lots, New York	\$208.00-\$210.00
NICKEL: "F" Ingots (5 pounds) F.o.b. Port Colbourne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5% per pound	\$6.50-\$7.00
TELLURIUM: Common grade, Per pound	\$4.00
THORIUM: per kilogram	\$43.00
TIN: Grade A Brands, New York (Per pound) Prompt delivery	101.00¢
TITANIUM: 99.3% + Grade A-1 Sponge (Per pound)	\$1.50-\$16.75
URANIUM: Red (0.790 U-235) \$16.00 Per Pound; Foil	\$7.75
U-235: Nominal (per pound)	\$35.00
GOLD: United States Treasury Price	\$90.5¢
SILVER: Newly mined domestic, U.S. Treasury price per ounce	91 3/4¢
Foreign Handy Harmon	\$82.00-\$85.00
PLATINUM: Per ounce	\$5.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: 10 to 12% BeO, F.o.b. mine, Colorado	\$46.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$48.00.	
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons.	
African (Rhodesian), 48% Cr ₂ O ₃ , 3 to 1 ratio	\$33.00-\$36.00
African (Transvaal), 48% Cr ₂ O ₃ , No ratio	\$26.00-\$28.00
Turkish, 48% Cr ₂ O ₃ , 3 to 1 chrome-iron ratio	Nominal \$36.00-\$37.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide	Nominal \$1.10
IRON ORE: Lake Superior. Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe	\$11.45

Mesabi, Bessemer, 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Lump: Plus 1/2-inch	\$12.85
Fines: Minus 1/2-inch	\$10.72
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	24.00-25.00¢
MANGANESE ORE: Metallurgical grade, 48 to 50% Mn Long ton unit	\$0.95-\$1.00
Metallurgical grade, 46 to 48% Mn. Long ton unit	\$0.90-\$0.95
Metallurgical grade, 44 to 45% Mn. Long ton unit	\$0.85-\$0.90
Domestic U.S. Government, GSA Basis \$2.30 per unit for 19% Mn.	
MOLYBDENITE CONCENTRATE: 90% MoS ₂ F.o.b. Climax, Colorado, Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic, 60% WO ₃ Per short ton unit	Nominal \$24.00
Foreign: 65% WO ₃ Per short ton unit (Scheelite)	Nominal \$20.25
Foreign: South American, Spanish, Portuguese	Nominal \$20.00
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U ₃ O ₈ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

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BARITE: Oil well drilling. Minimum 4.25 specific gravity, per short ton	\$16.00
BENTONITE: Minus-200mesh, F.o.b. Wyoming. Per ton, carload lots	\$12.50
Oil Well grade. Packed in 100 pound paper bags	\$14.00
BORON: technical grade F.o.b. Boron California. Per ton	\$47.50
FLUORSPAR: Metallurgical grade, 72.5% effective CaF ₂ content per short ton F.o.b. Illinois-Kentucky mines	\$37.00-\$41.00
Mexican, 70% F.o.b. border, Duty paid	\$26.00-\$27.00
Acid Grade, 97% CaF ₂ Bulk, F.o.b. mine	\$45.00-\$49.00
PERLITE: Crude: F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades, Crushed and sized, F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$22.50-\$23.50

London

	Per Long Ton	USA Equivalent	cents per pound
COPPER: Electrolytic spot	£225	10s 0d	28.19¢
LEAD: Refined 99%	£ 63	2s 6d	7.89¢
ZINC: Virgin, 98%	£ 79	2s 6d	9.89¢
ALUMINUM: Ingot, 99.5%	£186	0s 0d	23.25¢
ANTIMONY: Regular, 99.6%	£207	10s 0d	25.94¢
TIN: Standard, 99.75%	£796	0s 0d	99.50¢
TUNGSTEN: Long ton unit	£ 0	150s 0d	\$21.00¢

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FOR SALE—S&H model 30 gasoline powered core drill on 1959 Dodge W300M power wagon. Less than 100 hours total time. Accessory list, price and delivery on request to purchasing agent, Florida Tile Industries, Inc., P.O. Box 451, Lakeland, Florida.

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MINING GEOPHYSICIST — Major iron ore producer seeks to hire young man for permanent position on exploration program in midwestern U.S. Salary open. Write Box 100, Mining World, 500 Howard St., San Francisco 5, Calif.

FOR LEASE — Flagstone and building stone quarries; located south of Burns, Oregon. Contact Robert Hallett, P.O. Box 83, Sumner, Washington.

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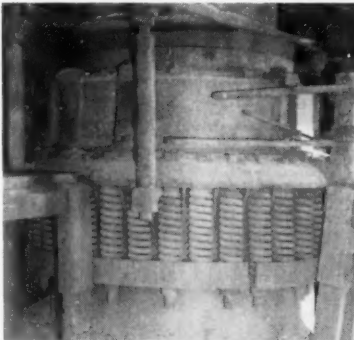
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1-11 1/2' x 12' Oliver drum, complete accessories

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1-156 KVA GMC Diesel, 440 V
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8-Joy, L-111, tugger, air
1-Ingersoll Rand, SNNOH, slurher, 440 V
10-Gardner-Denver, HB, slurher, air
3-Ingersoll-Rand, 10NNIG, slurher, 440 V
7-Joy, FF211, slurher, 440 V
1-Joy, FF311, slurher, 440 V

JIGS

2-16" x 24" Denver Duplex Jigs, 1 1/2 HP motor

LOCOMOTIVES

3-1 1/2 Ton Mancha "Little Trammer", Edison Batteries, 24" ga., complete

THIS IS A PARTIAL
INVENTORY—GET OUR LISTS

1-4 ton Mancha "Titan A", Edison Batteries, 24" ga., complete
1-8 Ton Plymouth diesel, 24" ga. w/scrubber

MUCKING MACHINES

1-12B Eimco "Rockershovel", 24" ga.
2-#21 Eimco "Rockershovel", 24" ga.
1-12B Eimco "Rockershovel", 18" ga.

PUMPS

1-No. 25 Ingersoll Rand Pump, air
1-No. 35 Ingersoll Rand Pump, air

16' & 8' Gayco Air Separator W/Motor
24"x95" Hewitt Robins Belt Conveyor New
2-5'x8" Kennedy Van Saun Air Swept Ball
Tube Mills with disc feeders, fans, piping
4 1/2'x9" KVS Air Swept Ball Mill
2 Wemco 2M—HMS Plants
6'x4' & 6'x9' Traylor Ball Mills
No. 56 and 7'x15' Marcy Ball Mills
10'x48" & 6'x36" Hardinge Ball Mills
4'x11' & 7'x15' Marcy Rod Mills
18"x36" & 15"x24" Rogers RB Jaw Crushers
14"x28", 30x36 & 48"x72 Jaw Crushers
42" Traylor Gyratory Primary Crusher
48" x 60" Allis Chalmers 6 Pcs. Frame Jaw
Crusher
5 1/2' Symons Std. Cone Crusher
7' Symons Short Head Cone Crusher
10—No. 6s Wilfley Concentrating Tables
78"x36" 6" Akins Duplex Spiral Classifier
8'x37'x19' Dorr Bow Rake Classifier
8'x60" Rotary Dryer 1/2" Welded Shell
3'x30', 9'x162" Allis Chalmers Rotary Kilns
4-30"x32" Dings Magnetic-Head Pulleys
8, 12, 23, 25, 45, 60 & 100 ton GE & GM
Diesel Electric Locomotives
25 ton Ind. Brn. Hoist Del. Loco. Crane
6-2200 & 3078 Ingersoll Rand Elec. Compressors
DARIEN, 60 E. 42nd Street, N.Y. 17, N.Y.

Mancha Little Tramper Loco. Late serial
Mucker 12-B Eimco — Late serial
Air Tuggers GDCo. Model HK; 2000# cap
Feeder A-W Lima 42"x12 ft; steel apron
Ball Mill 5x10 ft. Allis-Chalmers
Ball Mill 6 ft. dia. x 5 ft. Straub
Ball Mill 5 ft. dia. x 6 ft. Colo. 1. Wks
Rod Mill 4x10 ft. Hardinge; periph. end dis
Classifier 8x21" 8" Dorr DSF duplex-rake
Crusher 20x36 Universal rlr-brg
Crusher 15x30 Buchanan Blake type
Crusher 10x20 Denver Eq. rlr-brg
Crushers 3 Kue-Ken 18" Gyracone
Rolls 42x16 Allis-Ch. w/new parts
Triple Roll 30x18 Pioneer w/new parts
Rolls 30x18 Cedar Rapids
Flotation 6-Cells 56x56 Fag v-belt-dr
Filter 3-Leaf 6 ft. American w/vac. eq
Thickener 28x10 Dorr low-head w/steel tank
Samplers 60" & 28" Vezin standard type
Jig 24x36 Denver duplex Mineral Jig
Krebs Cyclones 2 Size EE10B-4B 2-stage
Magnet 40" dia. Stearns w/rectifier, etc

Paul F. Smith

39 W. Adams St. Phoenix, Arizona

RECENT PURCHASES!

- 1—Symons 2' standard cone crusher, 30 HP
- 2—Bonnet 7' x 60" rotary dryers, 3/8" shell
- 2—Bonnet 6' x 52' -6" rot. dryers, fans, cyclones
- 2—Davenport 8' x 60" dryers, 7/16" welded
- 1—Louisville 7' x 70" rotary cooler, 1/2" welded

SEND FOR CIRCULAR #360-A

- 1—Vulcan 10' x 11' x 175' rotary kiln, 13/16" shell, 2-tire, firing hood, etc.
- 3—National Iron 10' x 78' rotary dryers, 3/4"
- 1—8' x 10' x 125' kiln, 5/8" shell.
- 2—Hardinge 8'8" x 70' rotary dryers, 5/8" welded shell, class #XA-18, complete
- 1—8' x 60" rot. kiln, 1/2" welded shell.
- 1—Kennedy 7' x 9' contin. ball mill
- 2—Hardinge 7' x 36" conical pebble mills
- 3—Allis-Chal. 5' x 22' ball mill, 150 HP.
- 1—Hardinge 4' -6" x 16" conical ball mill.
- 5—JAW CRUSHERS: 36" x 15", 24" x 13", 20" x 6", 18" x 9", 8" x 10"
- 1—24" x 538" trough-belt conveyor.

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1429 N. SIXTH ST.
PHILADELPHIA 22, PA.
POPLAR 3-3505

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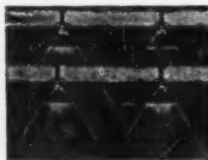
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The simplicity, convenience and novelty that characterize all CONCENCO equipment extend even to such small devices as Spray Nozzles. These economical components require no threading. You simply drill oversize holes in the supply line, clamp on the nozzles and get effective spray action, made possible by machined orifices and easily adjusted nozzle positions. Send for complete information.

The Original Deister Co., Incorporated 1906

The Deister Concentrator Co., Inc.
925 Glasgow Ave., Fort Wayne, Indiana

This Red Rubber is a better rubber for runners pumping abrasive pulps because it has...



Higher tensile
strength

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and
Greater abrasion
resistance

**This permits handling coarser pulps at
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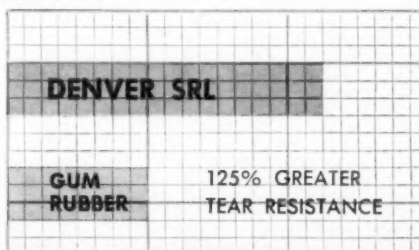
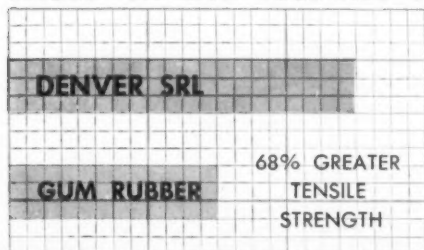
This abrasive resistant stock is standard on all runners for DENVER SRL and SRL "Tru-Glandless" Pumps (sizes to 10" x 8"). Other polymers are available for applications involving high temperatures, oils or acids where abrasion is a secondary problem.

These DENVER SRL Pump runners are especially suited for pumping grinding mill discharge to cyclone classifiers where coarse particles (up to 3/4") normally would be a problem.

Tough, live DENVER SRL Red Rubber outwears, outlasts, outperforms generally-used gum rubber and allows DENVER SRL Rubber Lined Pumps to be used where metal pumps have been considered necessary.

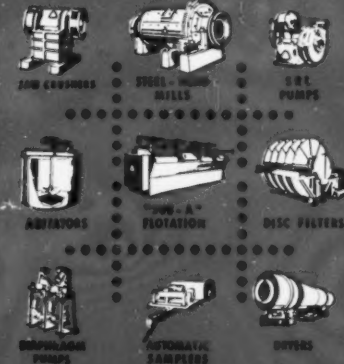
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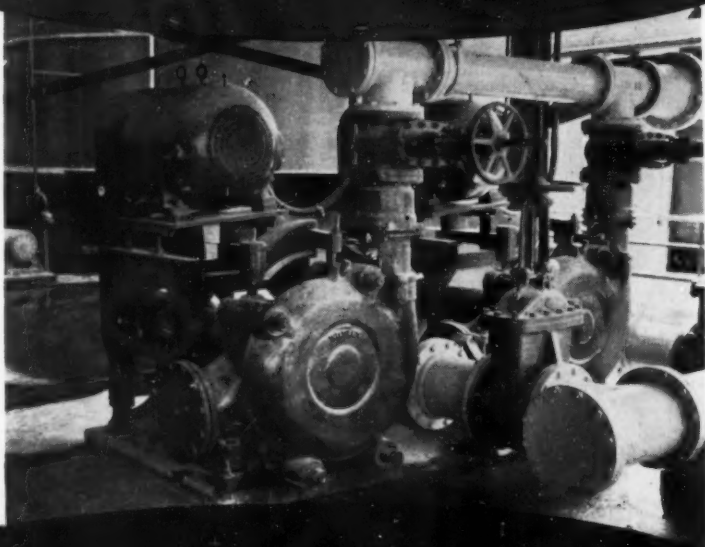
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